Consolidated product

Software Process Assessment – Part 5 : Construction, selection and use of assessment instruments and tools

Version 1.00

(Formerly AI 1.00)

PREAMBLE

In January 1993 a program of work was approved by ISO/IEC JTC1 for the development of an international standard for software process assessment. In June 1993 the SPICE Project Organisation was established with a mandate from JTC1/SC7 to:

- assist the standardisation project in its preparatory stage by developing initial working drafts;
- undertake user trials in order to gain early experience data which will form the basis for revision of the Technical Report prior to publication as a full International Standard;
- create market awareness and take-up of the evolving standard.

The SPICE Project Organisation completed its task of producing the set of working drafts in June 1995. The SPICE user trials commenced in January 1995. The working drafts have now been handed over to JTC1/SC7 for the normal process of standards development, commencing in July 1995.

So far as can be determined, intellectual property rights for these documents reside with the individuals and organisations that contributed to their development. In agreeing to take part in the Project, participants agreed to abide by decisions of the Management Board in relation to the conduct of the Project. It is in accordance with this understanding that the Management Board has now agreed to release the baseline set of documents. This introductory statement sets out the terms and conditions under which this release is permitted.

The documents as released are available freely from the SPICE Project File Server, sisyphus.cit.gu.edu.au, by anonymous ftp, or from approved mirrors of the server. A hypertext version of the documents is also available on the World Wide Web at URL http://www-sqi.cit.gu.edu.au/spice/

TERMS AND CONDITIONS

These terms and conditions apply to the set of documents developed by the SPICE Project, and published within the Project as Version 1.0, with the following titles:

– Part 1 : *Concepts and introductory guide*
– Part 2 : *A model for process management*
– Part 3 : *Rating processes*
– Part 4 : *Guide to conducting assessment*
– Part 5 : *Construction, selection and use of assessment instruments and tools*
– Part 6 : *Qualification and training of assessors*
– Part 7 : *Guide for use in process improvement*
– Part 8 : *Guide for use in determining supplier process capability*
– Part 9 : *Vocabulary*

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Acknowledgment:

Acknowledgment is made to all contributors of the SPICE project without whom the project could not have been conceived and carried through successfully.

Note on document formatting

Use the following margins for equivalent printing on A4 or US letter paper (these are NOT the SPICE standards)

Paper size	**A4**	**US letter (imperial)**
Top margin	34.1 mm or 1.34 inches	25.4 mm or 1.0 inches
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The document was composed in Helvetica 10 pt for A4 paper. There may be minor variations in the pagination of some of the big tables for font Arial 10 pt and/or use of US sized paper.

SOFTWARE PROCESS ASSESSMENT Part 5

Construction, selection and use of assessment instruments and tools

Contents

Foreword

In June 1991, the fourth plenary meeting of ISO/IEC JTC1/SC7 approved a study period (resolution 144) to investigate the needs and requirements for a standard for software process assessment.

The results, which are documented in a Study Report (JTC1/SC7 N944R, 11 June 1992), came to the following major conclusions:

- there is international consensus on the needs and requirements for a standard for process assessment;
- there is international consensus on the need for a rapid route to development and trialing to provide usable output in an acceptable timescale and to ensure the standard fully meets the needs of its users;
- there is international commitment to resource the project with an international project team staffed by full time resource, with development being co-ordinated through four technical development centres in Europe, N America (2) and Asia Pacific;
- the standard should initially be published as a Technical Report Type 2 to enable the developing standard to stabilise during the period of the user trials, prior to its issuing as a full International Standard.

The new work item was approved in January 1993 by JTC1. In June 1993 the SPICE Project Organisation was established with a mandate from JTC1/SC7 to:

- assist the standardisation project in its preparatory stage to develop initial working drafts;
- undertake user trials in order to gain early experience data which will form the basis for revision of the published Technical Report prior to review as a full International Standard;
- create market awareness and take-up of the evolving standard.

The SPICE Project Organisation completed its task of producing the set of working drafts in June 1995. These working drafts have formed the basis for this Technical Report Type 2. The period of SPICE user trials commenced in January 1995 and is synchronised in phases to allow feedback to the stages of the technical work.

ISO/IEC Directives state that a Technical Report Type 2 may be used to publish a prospective standard for provisional application so that information and experience of its practical use may be gathered.

This Technical Report Type 2 consists of the following parts, under the general title *Software Process Assessment:*

- Part 1 : *Concepts and introductory guide*
- Part 2 : *A model for process management*
- Part 3 : *Rating processes*
- Part 4 : *Guide to conducting assessment*
- Part 5 : *Construction, selection and use of assessment instruments and tools*
- Part 6 : *Qualification and training of assessors*
- Part 7 : *Guide for use in process improvement*
- Part 8 : *Guide for use in determining supplier process capability*
- Part 9 : *Vocabulary*

In this part of the standard (Part 5) Annexes A, B, C and D are normative. Annexes E to H are informative.

Introduction

This document establishes the requirements for constructing an assessment instrument. In addition, it provides guidance on selection and usability characteristics associated with various types of assessment instrument. The other components of the standard, their relationships and interdependencies, are described in part 1 of this International Standard.

When an assessment is performed, the organization's implemented processes are compared with the process model defined in part 2 of this International Standard. Typically, during an assessment it is not realistic to build a complete process model of the entire organization. Hence, to determine whether a process has been sufficiently implemented, the assessor probes for evidence of the actual capability of the process. Information is collected about a representative sample of process attributes that is evaluated against the expected attributes. Based upon a review of this information, an assessor makes a judgement about the process capability of the organizational unit.

An assessment instrument (AI) is a tool (or set of tools) used throughout an assessment to support the evaluation of the adequacy or existence of practices. An assessment instrument aids the assessor by providing a consistent set of indicators as discriminators to help judge how well the practices have been implemented in the organizational unit's processes. An assessment instrument provides a mechanism to record the collected information from an assessment. Storage and retrieval capabilities provide the ability to maintain the results and supporting information for post-assessment analysis and improvement. Sophisticated assessment instruments may help the assessor to process the data and generate the results, thereby improving the efficiency and effectiveness of the assessment.

This part of the International Standard describes a framework for an assessment instrument. An important aspect of the framework is a set of assessment indicators that are the source input data to an assessment instruments. Other elements of the framework incorporate the ability to capture and process assessment data to produce repeatable results. Different types of assessment instrument support specific assessment techniques, objectives or modes of use. This document does not prescribe a particular format for an assessment instrument (e.g., questionnaire, checklist, computer input screen): the requirements for an assessment instrument are independent of a particular design, instrument style or mode of use. Assessment tool designers and methodology providers should evaluate the intended approach to gathering data and build an assessment instrument that supports the assessment approach.

It is important that each assessor performs the assessment in a consistent and repeatable manner to ensure the validity, usability and comparability of the assessment results. The common set of assessment criteria available in an assessment instrument through the indicators help to provide consistent and repeatable assessment results.

1. Scope

This part of the International Standard defines the required elements of an assessment instrument to support an assessment conducted according to this International Standard. It also provides guidance on the construction or selection of different types of assessment instruments. This document:

- sets out the minimum requirements to be met in the construction of an assessment instrument;
- defines a set of indicators to be included in an assessment instrument;
- provides guidance on the selection, construction and usability of assessment instruments.

Different types of assessment instrument support specific assessment techniques, objectives or modes of use. This document does not prescribe a particular format for an assessment instrument (e.g., questionnaire, checklist, computer -based tool); the requirements for an assessment instrument are independent of a particular design, instrument style or mode of use.

The set of indicators included in this part of the International Standard is not intended to be an all inclusive set, but rather provide the key characteristics of an instantiation of an assessed process that may be useful to judge adequacy. Requirements for tailoring the standard set of indicators are provided in Clause 4.

This part of the International Standard is directed to:

- those responsible for the design and construction of assessment instruments, e.g. methodology providers, tool suppliers, assessors;
- assessors and assessment teams with responsibility for the selection and procurement of appropriate assessment instruments;
- assessors, sponsors or other parties responsible for assessing conformance of an assessment instrument to these requirements.

2. Normative References

There are no normative references in this part of the International Standard.

3. Definitions

For the purposes of this part of this International Standard, the definitions in *Software Process Assessment - Part 9 : Vocabulary* apply.

4. Construction of an assessment instrument

4.1 Form and purpose of an assessment instrument

For the purposes of this International Standard, an assessment instrument is a tool or set of tools that is used throughout an assessment to support the evaluation of the existence or adequacy of practices within the scope of the assessment. It may provide assistance in collecting, recording, formalizing, processing, using, storing or retrieving information gathered during an assessment.

This International Standard does not require an assessment instrument to take any particular form or format. It may be constructed to be, for example, a paper-based instrument containing elements such as forms, questionnaires or checklists, or it may take the form of a computer-based instrument such as a spreadsheet, a data base system, an expert system or an integrated CASE tool.

4.2 Implementation of standard indicators

Regardless of the form of the assessment instrument, its main objective is to help an assessor to perform an assessment in a consistent and repeatable manner, reducing assessor subjectivity and ensuring the validity, usability and comparability of the assessment results. As a primary means of achieving this objective, an assessment instrument shall incorporate the standard set of assessment indicators defined in Annexes A, B, C and D, as appropriate to the scope and context of the assessment.

All indicators incorporated into an assessment instrument shall be traceable to a corresponding process, generic practice, or base practice in the process model in part 2 of this International Standard, or to a practice in an extended process.

4.3 Tailoring of indicators contained in an assessment instrument

4.3.1 General

Within an assessment instrument, the standard set of indicators and the form of the instrument may be tailored to meet the needs of the assessment team or sponsor in the following aspects:

- the modification of indicator format to accommodate presentation style preferences (i.e., questions, sentences, tables, on-line input screens, etc.);
- the modification of indicator wording to accommodate synonym names or meaning for cultural differences;

– the addition of scoping characteristics to help select the set of indicators used by process area, user, job function, application domain, software product, or other pre-defined organizational unit or tool characteristics;

– the addition of new indicators to support new work products, new technology and specific extended processes;

– the adaptation of the assessment instrument to accommodate extended processes, limited scope modularity, or intended distribution of tools to collect the assessment data incrementally;

– the user interface (i.e., format for data input, method of recording data, etc.);

– the format of the results (presentation format and output record format, etc.);

– the overall design and format of the assessment instrument;

Tailoring the indicators shall not impair the availability of the standard set of indicators appropriate to the scope and context of the assessment.

All practices within the assessment scope shall be covered by the tailored indicators.

4.3.2 Tailoring indicators for extended processes

This International Standard allows for the creation of extended processes containing additional practices to supplement those in the process model in part 2. When extended processes are defined, the following shall apply:

– corresponding indicators shall be defined and included in the assessment instrument for each additional practice in the extended process;

– a reference shall be recorded in the assessment record identifying the indictors related to the practices in extended processes;

– indicators for the practices in extended processes shall be maintained and made available to the sponsor or the assessed organization on request.

4.4 Modular assessment instruments

A modular assessment instrument is an instrument constructed or tailored from a collection of components, each of which provides only partial coverage of the full scope of the process model. A modular assessment instrument, at a minimum, shall incorporate all standard indicators related to the processes to be assessed and all of the process management indicators.

Assessors using a modular assessment instrument shall record any limitation of the coverage of the instruments used in the assessment record.

The use of a modular assessment instrument shall not negate the rules for coverage of the practices contained within this International Standard.

A supplier of a modular assessment instrument should clearly identify the applicability of the instrument and the extent of its coverage of the process and practices of the process model in part 2 or of extended processes.

4.5. Capturing and processing assessment data

An assessment instrument shall have the ability to capture the data required to be used in the production of ratings as defined in part 3 of this International Standard.

NOTE 1: In paper-based instrument, for example, this could be met simply by providing a place to write the results.

An assessment instrument shall have the ability to capture and maintain supporting information as required by the assessment sponsor and defined in the assessment input.

An assessment instrument shall support the rating of the practices being assessed, including those contained in extended processes, according to the rating scheme defined part 3 of this International Standard.

When an extended process is included in the scope of an assessment, the assessment instrument should enable the assessor to segregate the rating of the base practices contained in the process model from the additional base practices in an extended process.

An assessment instrument should provide a mechanism to aid the segregation of data and results between the assessment output as defined in part 3 of this International Standard.

An assessment instruments should, whenever possible, provide automated support to the assessor for the processing and aggregation of results across multiple organizational units or process instances.

4.6 Using an assessment instrument

The assessment instrument should be appropriate to the scope and purpose of assessment.

Assessors should record the existence, absence, or non-applicability of the indicators used in the assessment.

The assessment instrument records of the existence, absence or non-applicability of the indicators should be provided to the assessed organizational unit upon request to allow the use of the information in subsequent process improvement planning.

Assessment instrument records should be maintained by the assessor's organization as a record of the assessment.

An assessment instrument should be capable of loading, storing and comparing process profiles.

Assessors should use all the data captured in an assessment instrument about indicators, the context of the assessment, and the organizational unit characteristics to support their judgements of practice adequacy or existence.

Annex A (normative)

Process management indicators

Introduction

Process Management Indicators provide guidance to the assessor on what to probe for in the organization to determine whether the generic practices, defined in part 2 of this International Standard, have be adequately implemented. Generic practices are applicable to every process. They provide the assessor with a view of the organization's ability to manage its processes. The Process Management Indicators should be used in conjunction with the practices in part 2 of this International Standard (which are not duplicated in this document) and the Work Products Characteristics contained in Annex D. The practices, together with the work product characteristics form the set of Process Indicators. These indicators help the assessor judge the adequacy of the generic practice 1.1.1 "Perform the process".

The information in Annex B and Annex C provide a way to map the appropriate process and practices to the information contained in Annex D. The information in all these tables provides guidance to the assessor in how to judge "practice adequacy". This information may be tailored by the assessment instrument tool designer or assessor according to the rules defined in clause 4 of this part of the standard.

The Process Management Indicators table contains the following fields:

Associated Processes / Practices:	Defines other processes and/or practices which may be used to support the assessment of this practice
Potential Sources for Existence Evidence:	Defines potential artefacts where an assessor might look to find evidence that this practice was implemented in the organization. This field lists equivalent artefacts which could be used to demonstrate that the practice was implemented. The list is not inclusive.
Process Management Indicators:	The phrases or key words that provide guidance to the assessor in what to probe for during an assessment in making a judgement of "adequacy". An assessor probes for all of the things listed. Then their judgement is based on the information gathered supported by the context information defined for the assessment.

Process Management Indicator Table

Level 1	**Performed-Informally**

Common Feature 1.1:	**Base Practices are Performed**

Practice:	**1.1.1**
Perform the process.	**Perform the base practices in implementing the process to provide work products and/or services to a customer.**
Associated Processes/Practices:	This practice applies to each process within the scope of the assessment. Note: To help evaluate this generic practice use the Process Indicators defined in Annexes B - D and the base practices.
Potential Sources for Existence Evidence	– Any input and output work product associated with the process – Discussions with process representatives

Process Indicators	The process is performed in the organization.
	– Evaluate each base practice for each instance of the process being reviewed.
	  – each base practice is represented in the process defined in the organization.
	  – the process representatives can demonstrate that the base practices for process are used (even though the process may not be documented).
	– In each organizational unit assessed, evidence exists that each base practice is actually performed.
	  – samples of the input and output work products similar to those specified in the process in part 2 of this International Standard exist and have the characteristics to indicate an adequate implementation (see Annex D).
	  – a mechanism exists to distribute the work products associated with the process.

Note 1: At Level 1 a process may not be documented, just performed informally. An organization that has the capability to perform at a higher level of maturity will have a more well defined process. To assess this, the assessor should use the Process Indicators along with the Process Management Indicators. The attributes observed in the process will help define the organization's level of capability.

Note 2: If using an *automated* self-assessment tool the assessor may just indicate in the tool that the practices for process are performed, and record the information about work products characteristics, and practice adequacy scores, capturing any evidence that might substantiate the self-assessment results if required at some later point.

Process Management Indicator Table

Level 2 Planned-and-Tracked

Common Feature 2.1: Planning Performance

Practice:	**2.1.1**
Allocate resources.	**Allocate adequate resources (including people) for performing the process.**
Associated Processes/Practices:	**PRO.7.1** - Acquire Resources.
Potential Sources for Existence Evidence	– Current project specification or plan (17) – Current progress status (20, 89) – Process performance data (18) – Estimates (tools/records) (11) – Historical records of similar projects (18, 20) – Process measures (38) – Schedule (5) – Commitments/agreements (50) – Process representative – Tour of facilities – Overtime records

Process Management Indicators	– Evidence of resource allocation exists. Resource(s) may include:
	  – funding
	  – staff
	  – equipment
	  – workspace
	  – tools
	– Process representative(s) indicate that resources are sufficient to perform tasks assigned
	– Records/plan indicate resources are allocated to perform job tasks
	– Project tracking shows resource utilization consistent with current project plan
	– Where historical records exist:
	  – allocation of resources are consistent with the historical records of projects with similar scope.
	  – resources estimates are based on historical data (when it exists).

Process Management Indicator Table

Level 2	Planned-and-Tracked

Practice:	**2.1.2**
Assign responsibilities.	**Assign responsibilities for developing the work products and/or providing the services of the process**
Associated Processes/Practices:	PRO.3 - Build Project Teams
Potential Sources for Existence Evidence	– Process description (3) – Job procedures/practices (4) – Project plans (17) – Work breakdown structure (6) – Training records (89) – Review strategy/plan (30) – Process representative
Process Management Indicator	– Job responsibilities correspond to tasks attributes defined in the practices. – Representative understands the process and tasks they are responsible for. – Staff assigned either have the skills or are planned to have the skills needed to perform the task. – Assigned responsibilities are recorded

Process Management Indicator Table

Level 2 Planned-and-Tracked

Practice:	**2.1.3**
Document the process.	**Document the approach to performing the process in standards and/or procedures.**
Associated Processes/Practices:	ORG.2 Define the Process. SUP.1 Develop Documentation PRO.1.3 Describe Activities and Tasks PRO.2.2 Identify Project Standards
Potential Sources for Existence Evidence	– Process descriptions (3) – Standards (9) – Coding standards (10) – Job procedures or practices (4) – Quality strategy (25) – Review strategy (30) – Customer support procedures (82) – Installation guide (75) – Configuration management plan (91) – Project management tools

Process Management Indicators	– Process approach and tasks to be performed for the organizational unit are documented.
	– Procedures documented are the procedures used by the organizational unit.
	– Process documented contains elements defined in Org.2, such as:
	  – tasks to be performed
	  – inputs and outputs
	  – entry / exit criteria
	  – control points
	  – internal and external interfaces
	  – process measurements
	– In defining tasks consideration is given to:
	  – sequencing of tasks
	  – task dependencies
	  – good practices to follow in performing the tasks
	– Standard and procedure documents for the organizational unit are developed consistent with SUP.1:
	  – requirements are identified
	  – documents are checked
	  – documents are maintained
	– Process owners/users have input to defining the documented process / procedures.

Process Management Indicator Table

Level 2	Planned-and-Tracked

Practice:	**2.1.4**
Provide tools	**Provide appropriate tools to support performance of the process.**
Associated Processes/Practices:	ORG.6 Provide Software Engineering Environment. ORG.7 Provide Work Facilities
Potential Sources for Existence Evidence	– Development environment (104) (see the associated process indicators)
Process Management Indicators	– Tools are used support the process activities defined in the organizational unit. – Practitioners verify that the tools in use meet their needs. – Tools defined are available to those who perform the task(s). – Adequate number of tools are available to support the activities defined – Tools used add value to the required tasks – Personnel who use the tools receive adequate training in the operation of the tool – Documentation and/or instructions is available for the tool – Support for the tool is available

Process Management Indicator Table

Level 2	Planned-and-Tracked

Practice:	**2.1.5**
Ensure training.	**Ensure that the individuals performing the process are appropriately trained in how to perform the process.**
Associated Processes/Practices:	ORG.4 - Perform Training * This is applied to each process in the scope of the assessment.
Potential Sources for Existence Evidence	– Training strategy/plan (88) – Mentoring plan – Training records (89) – Training materials (90) – Formal course materials – Written project materials – On-line job aids – Video library – Training curricula – Project plan (17) – Personnel records (109) – Estimates (11)

Process Management Indicators	– Training needs for the staff performing the tasks are identified
	– Practitioners verified that training was sufficient and adequate to perform the tasks assigned:
	  – training is available for tools used in the process tasks performed
	  – training curricula covers tasks in the defined process.
	– The organizational unit allocated resources for training:
	  – resources cover training costs
	  – time is allocated in project plan for staff training when required
	  – training materials for the process exist
	  – personnel records indicate staff had sufficient training in the process tasks assigned.
	– Training could take the form of:
	  – internal training (training classes, self-instruction tools)
	  – external training (ex. degrees, courses taken outside company, certification)
	  – prior expertise / experience
	  – mentoring related to process tasks they are assigned to

Process Management Indicator Table

Level 2 Planned-and-Tracked

Practice:	**2.1.6**
Plan the process.	**Plan the performance of the process.**
Associated Processes/Practices:	PRO.2 Establish Project Plan. PRO.5 Manage Quality PRO.6 Manage Risks
Potential Sources for Existence Evidence	– Project plan(s) (17) – Work breakdown structure (6) – Review strategy/plan (30) – Reuse strategy (33) – Risk management strategy/plan (23) – Risk analysis record/report (22) – Quality strategy (25) – Estimates (tools/records) (11) – Quality records (28) – Measures (36) – Project management tools – CASE tools
Process Management Indicators	– The **plan** contains the key elements: – **Work breakdown structure** is defined including at least the tasks specified in part 2 if this International Standard for the process being reviewed. – **Project standards** to be used are identified and available. – **Special needs** (facilities, tools, personnel) are identified, along with resources to obtain the special need. – **Reuse strategy** is defined and identifies the: – key elements to be reused – the objectives for reuse within the project – the mechanism used to implement reuse – **Project resource estimations** are: – based on historical information when available – consistent with resources available to the project – based on project measurements (see 2.4.1) – Project measures used in estimation are identified – **Project risks** are identified and reflect the: – resources utilization – availability of resources – schedule constraints – cost constraints – technical risks – **Schedule** is defined which – reflects the constraints considered (resources, time, personnel skills) – contains appropriate contingency time – meets customers needs and objectives

Process Management Indicator Table

Level 2	Planned-and-Tracked

Process Management Indictors (continued)	– The **plan** defined is:
	  – complete
	  – accurate
	  – easy to understand
	  – realistic
	  – available to those performing the task
	  – consistent with schedule needs and project objectives
	– and
	  – contains project commitments
	  – covers the strategy (approach / methodology / life cycle)

Process Management Indicator Table

Level 2	**Planned-and-Tracked**

Common Feature 2.2:	**Disciplined Performance**

Practice:	**2.2.1**
Use plans, standards, and procedures.	**Use documented plans, standards, and/or procedures in implementing the process.**
Associated Processes/Practices:	ORG.2.13 Deploy the Process PRO.5 Manage Quality PRO.6 Manage Risks PRO.7 Manage Resources and Schedules PRO.8 Manage Sub-Contractors
Potential Sources for Existence Evidence	– Project plans (16,17) – Quality plan (25) – Process performance data (18) – Process status record (20) – Meeting minutes (19) – Estimates (tools/records) (11) – Quality records (28) – Risk analysis record/report (22) – Assessment audit record (29) – Review record (31) – Measures (36-42) – Training records (89) – Process representative

Process Management Indicators	– Organizational unit representative understands the documented process / standards and / or procedures
	– Evidence exists that the documented process is used:
	  – input/output work products exist
	  – tasks to be performed have been assigned
	– Process defined is achievable with the project constraints
	– Evidence exists that the plans defined are used by the organization:
	  – plan milestones are achieved or replanning is performed
	  – schedule is consistent with the plan defined or replanning performed
	  – resources used are in line with those specified in the plan or replanning performed
	  – potential risks identified in the plan are tracked

Process Management Indicator Table

Level 2 Planned-and-Tracked

Practice:	**2.2.2**
Do Configuration Management.	**Place work products of the process under version control or configuration management, as appropriate.**
Associated Processes/Practices:	SUP.2 Perform Configuration Management
Potential Sources for Existence Evidence	– Listing of work products associated with the process – Configuration management plan (91) – Configuration management (file, library, system)(92) – Change requests (94) – Change control records (95) – Change history (96) – Progress status record / report (20) – Build list(57) – Release package (70)

Process Management Indicators	– All appropriate work product are maintained under configuration management
	– A storage mechanism for configured items exists, such as:
	  – paper document library
	  – project files or binders
	  – on-line configuration management system library
	– The configuration management (CM) mechanism:
	  – has archival / retrieval capabilities
	  – has an index of items under CM
	  – has controlled access procedures
	  – indicates the status of items under CM
	  – has a version indicator scheme
	– Work Products identified for the process have version indicators identified, for example:
	  – on-line documents have ability to generate version information
	  – printed documents have version identifiers on them
	– Baselined copies of the work product for the process correspond to the project's current development status.
	  – current status of the work product can be readily ascertained
	– Work products are accessible to organizational unit personnel with a "need to know":

Process Management Indicator Table

Level 2	Planned-and-Tracked
Process Management Indicators	– Change control is established for items baselined under CM: – change control procedure requires approval for change to baselined products – a mechanism to track changes made is established – process revisions are proactively made available to those who need them – a mechanism to inform project personnel of changes made to baselined documents exist

Process Management Indicator Table

Level 2 Planned-and-Tracked

Common Feature 2.3: Verifying Performance

Practice:	**2.3.1**
Verify process compliance.	**Verify compliance of the process with applicable standards and/or procedures**
Associated Processes/Practices:	SUP.3 Perform Quality Assurance. CUS.4.3 Conduct joint management reviews.
Potential Sources for Existence Evidence	– Standards (9) – Coding standards (10) – Product needs assessment(44) – Review records(31) – Assessment / audit record (29) – Progress status record / report(20) – Meeting minutes(19) – Corrective actions (97) – Process quality records (28) – Process measures (39)

Process Management Indicators	– Reviews, self-assessments and / or audits of the process are performed on a regular scheduled basis
	– Review, self-assessment and / or audit results exist:
	  – are documented and/or maintained
	  – indicate verification of appropriate standards and/or procedures
	  – identify adherence to appropriate standards and or procedures
	  – indicate corrective action plans for non- conformance to standards and or procedures
	  – are used in process improvement planning
	– Milestones and/or quality criteria defined for the process tasks include verification of the usage of the appropriate standard and procedures

Process Management Indicator Table

Level 2	Planned-and-Tracked

Practice:	**2.3.2**
Audit work products.	**Verify compliance of Work Products with the applicable standards and/or requirements.**
Associated Processes/Practices:	CUS.3 Identify Customer Needs PRO.4. Manage Requirements PRO.5 Manage Quality SUP.3 Audit work products* (duplicate requirement).
Potential Sources for Existence Evidence	– Customer request (83) – Customer requirements(52) – Standards (9) – Review records (31) – Assessment audit records (29) – Meeting minutes (19) – Progress status records (20) – Corrective actions (97) – Work product quality records (28) – Quality measures (29) – Requirements specification.(52) – Customer contracts (51) – Process input and output work products

Process Management Indicators	– Work product are reviewed:
	  – review criteria for work products include the verification of standards and/or requirements
	  – review records indicate usage of project standards and requirements
	– Quality criteria for work product completion verifies usage of the standards and/or procedures.
	– Requirement traceability is established for the work products:
	  – work product(s) are traceable to associated requirements or standards
	  – when CASE tools are used to store work product outputs, they have requirements traceability capabilities

Process Management Indicator Table

Level 2 Planned-and-Tracked

Common Feature 2.4: Tracking Performance

Practice:	**2.4.1**
Track with measurement.	**Track the status of the process against the plan using measurement.**
Associated Processes/Practices:	PRO.2.7 Identify project measures PRO.3.4 Manage inter-team issues PRO.7 Manage Resources and Schedule ORG.2.9 Define Process Measures CUS.4.3 Conduct joint management reviews.
Potential Sources for Existence Evidence	– Progress status(20) – Review records (31) – Assessment / audit record (29) – Corrective actions (97) – Process description (3) – Measures (36-42) – Project measures (37) – Tracking system (98) – Schedule (5) – Meeting minutes(19) – Project plan (17) – Project management tools

Process Management Indicators	– Measurements to track status of the process identify:
	  – key process attributes to be tracked
	  – status of deliverables
	  – quality of deliverables
	– Project measures cover key elements of the project plan:
	  – process / critical task status
	  – project performance against plan
	  – resource utilization against plan
	  – time schedule against plan
	  – process quality measures
	  – product quality measures
	– Process owners and customers participate in defining the measures / goals.
	– Milestones / quality objectives for each process are established.

Process Management Indicator Table

Level 2	Planned-and-Tracked

Process Management Indicators (Continued)	– The measures used are indicative of the process' performance
	  – progress deviations are identified.
	  – measures show planned vs. actual.
	  – process defects are identified .
	  – process quality vs. objectives/criteria.
	– The measures defined are:
	  – usable
	  – understood by those expected to utilize them
	  – provide value to users in the organization
	  – non-interruptive to the work flow
	– The reporting interval is appropriate for the life cycle model used.
	– Measurement reports are available to those with a need to know
	  – managers
	  – process owners
	  – interface groups
	  – quality representatives
	  – customers

Process Management Indicator Table

Level 2 Planned-and-Tracked

Practice:	**2.4.2**
Take corrective action.	**Take corrective action as appropriate when progress varies significantly from that planned.**
Associated Processes/Practices:	PRO.5.6 Take corrective action PRO.6.8 Take corrective action PRO.7.2 Track progress ORG.3.7 Change the process
Potential Sources for Existence Evidence	– Corrective actions (97) – Meeting minutes (19) – Project measures (37) – Process measures (38) – Progress status(20) – Schedules (5) – Project plans (17) – Trouble reporting system

Process Management Indicators	– A mechanism is defined to facilitate monitoring of the process, project, and product to identify when corrective actions are required
	– When projects performance is deviating from planned activities or performance goals:
	  – problems area are identified which have associated corrective actions
	  – established plans and schedules are adjusted
	  – notification is given to dependent task owners and customers
	– New requirements to a project result in a project analysis and potential replanning activities when required

Process Management Indicator Table

Level 3	**Well-Defined**

Common Feature 3.1:	**Defining a Standard Process**

Practice:	**3.1.1**
Standardize the process.	**Document a standard process or family of processes for the organization, which describes how to implement the base practices for the process.**
Associated Processes/Practices:	ORG.2 Define the Process SUP.1 Develop Documentation PRO.1.3 Describe activities and tasks **ORG.2.10 Document the standard process (duplicate base practice)*
Potential Sources for Existence Evidence	– Process description(3) – Job practices, procedure(4) – Work breakdown structure (6) – Standards (9) – Software development methodology (1) – Quality criteria (27)

Process Management Indicator Table

Level 3	Well-Defined

Process Management Indicators	– The organization's standard process documentation exists and includes:
	  – expected input and output work products
	  – work break down structure:
	  – tasks to be performed
	  – task ownership
	  – objective criteria for demonstrate the task completeness
	  – objective criteria to demonstrate the sufficiency of input and output work products
	  – definition of internal and external interfaces
	  – quality controls:
	  – process entry and exit criteria
	  – process decision control points
	  – process measures
	  – process performance characteristics and expectations
	  – performance characteristics for the standard or tailored process:
	  – productivity expectations
	  – quality expectations
	  – process adherence objectives
	  – estimated development resources:
	  – time
	  – cost
	  – personnel
	– The standard process is documented and provides coverage for the associated base practices
	– When defining measures consideration is given to ensure:
	  – usability of measures
	  – applicability of measures to the project
	  – availability of measures to those with a "need to know"
	  – completeness of source data used to generate the results
	  – validation of the accuracy of the source data
	– The standard process documented reflects the current practices performed throughout the organization
	  – documentation is validated (reviewed, tested)
	  – documentation is approved
	– Standard process is available to all with a *need-to-know* in the organization.
	  – paper documentation distributed to key process users
	  – on-line documentation is accessible to key process users

Process Management Indicator Table

Level 3	Well-Defined

Practice:	**3.1.2**
Tailor the standard process.	**Tailor the organization's standard process family to create a defined process which addresses the particular needs of a specific use.**
Associated Processes/Practices:	PRO.1 Plan Project Life Cycle, CUS.3 Identify Customer Needs, ORG.2 Define the Process, SUP.1 Develop documentation
Potential Sources for Existence Evidence	– Process description(3) – Job practices, procedure(4) – Work breakdown structure (6) – Standards (9) – Software development methodology (1) – Quality criteria (27) – Process management tools – Configuration management library / system(92)

Process Management Indicators	– Guidelines on how to tailor the standard process exist.
	– Tailoring guideline contain:
	  – criteria on what may be tailored
	  – approval process for tailoring
	  – usage criteria for the tailored process
	– The tailored process includes:
	  – tasks to be performed (e.g. work break down structure)
	  – objective criteria for demonstration of task completeness
	  – objective criteria for demonstration of inputs and output sufficiency for the next dependent task
	– Standard process documentation is adapted to include the tailored process.
	– Process documentation related to the tailored process is available to those who need it.
	– The tailored process is understood by organizational representatives using it.
	– Training is adapted to the tailored process and available to those who need it

Process Management Indicator Table

Level 3 Well-Defined

Common Feature 3.2: Perform the Defined Process

Practice:	**3.2.1**
Use a well-defined process.	**Use a well-defined process in implementing the process.**
Associated Processes/Practices:	ORG.2.13 Deploy the Process PRO.5 Manage Quality PRO.6 Manage Risks PRO.7 Manage Resources and Schedules PRO.8 Manage Sub-Contractors
Potential Sources for Existence Evidence	– Process description (3) – Job procedures, practices (4) – Work breakdown structure (6) – Work products (7) – Project plans (16,17) – Process performance data (18) – Process status record (20) – Meeting minutes (19) – Estimates (tools/records) (11) – Quality records (28) – Risk analysis record/report (22) – Assessment audit record (29) – Measures (36-42) – Training records (89)

Process Management Indicators	– The organization implements a standard process throughout the organization in a consistent way
	  – all projects use the same standard process or a tailored version of it
	– Organizational representatives:
	  – understand the standard / tailored process
	  – are trained in the standard / tailored process
	  – verify the performance of defined tasks
	– Quality criteria for proceeding from task to task exists
	  – entry criteria are met prior to the start of the process
	  – exit criteria are met prior to the completion of the process
	  – deviations from entry / exit criteria have documented, approved corrective actions defined.
	  – entry / exit criteria demonstrate the sufficiency of input and output work products to perform the scheduled tasks
	  – all defined exit criteria and / or corrective actions are tracked until completed.

Process Management Indicator Table

Level 3	Well-Defined

Process Management Indicators (Continued)	– The organization demonstrates the performance of all tasks defined in the standard or tailored process
	  – task completion verification mechanisms exists
	  – deviations from the defined process are documented, and officially approved
	– quality criteria are evaluated at key milestones in the defined process.
	– Input/output work products are monitored for:
	  – adherence to defined standards and requirements
	  – accuracy
	  – sufficiency to perform the next task (or process).
	  – completeness at the start of the next task.
	  – availability to those who need them in a time frame to support activities of the next task

Process Management Indicator Table

Level 3	Well-Defined

Practice:	**3.2.2**
Perform peer reviews.	**Perform peer reviews of appropriate work products of the process.**
Associated Processes/Practices:	SUP.5 Perform Peer Reviews
Potential Sources for Existence Evidence	– Review strategy/plan (30) – Review records (31) – Corrective actions (97) – Standards and procedures (5) – Project plans (17) – Work breakdown structure (6) – Meeting minutes (19) – Problem tracking systems (98) – Distribution list (77) – Work products list(7)
Process Management Indicators	– Project plans / schedules indicates adequate resources for the reviews are allocated (example: time, appropriate expertise, materials) – Peer reviews are performed for all key work products – list of work products to be reviewed for the process corresponds to those identified in project plan/specification. – Records of peer reviews exist which show: – that appropriate expertise participated in the peer review. – the time spent for the review – statistics about the number of faults found – problems which were identified have – corrective actions plans with target closure dates – status indicators – person responsible for closure – the status of the work product after the review – Quality and coverage criteria is available for the work product reviewed which assess: – the completeness of the work product – the adherence to standards – the coverage of requirements – if the information is understandable – usability for the subsequent task – accuracy and validity – Evidence of corrective action closure exists.

Process Management Indicator Table

Level 3	Well-Defined

Practice:	**3.2.3**
Use well-defined data.	**Use data on performing the defined process to manage the defined process.**
Associated Processes/Practices:	PRO.7.2 Track Progress ORG.2 Define the Process
Potential Sources for Existence Evidence	– Process description (3) – Work breakdown structures (6) – Quality criteria (27) – Process measures (38) – Quality records (28) – Corrective action (97) – Change control records (95)

Process Management Indicators	– Process measures are collected which monitor:
	  – timeliness planned tasks
	  – completeness of planned tasks
	  – sufficiency of the deliverable for the next task.
	  – the quality of the end customer deliverable
	  – usability of the deliverable
	– Measurement results are used in managing the process:
	  – project management plans reflect the use of the defined process measures
	  – change management criteria reflect the use of process trends
	  – corrective action are defined when data indicates deviations from established processes
	  – correct action results are monitored through the use of process measurement trend data

Process Management Indicator Table

Level 4 Quantitatively-Controlled

Common Feature 4.1: Establishing Measurable Quality Goals

Practice:	**4.1.1**
Establish quality goals.	**Establish measurable quality goals for the work products of the organization's standard process family.**
Associated Processes/Practices:	PRO.5.1 Establish Quality Goals PRO.5.2 Define Quality Metrics ORG.2.1 Define goals
Potential Sources for Existence Evidence	– Quality criteria (27) – Goals (12) – Quality strategy / plan (25) – Quality measures (39) – Process description (3) – Work products (7)

Process Management Indicators	– The organization has defined the desired work product quality characteristics and goals
	  – the quality goals for the work products assesses if the work product is sufficient to satisfy the objectives for its intended use.
	  – internal work product quality goals support the goals for the quality of the end customer product
	  – thresholds are established as part of the quality goals
	  – customer (internal and external) needs and expectations are considered when establishing quality goals
	  – quality goals and measures established are auditable, verifiable, repeatable
	  – cost /benefit analysis is performed to optimize quality goals
	– Standards exist for the organization's work products of the standard process family which:
	  – define the expected characteristics of the work products
	  – establish what is to be measured
	  – define the source data coverage
	  – define the applicability of the measures
	  – define the usability of measurements
	  – define availability of measurements
	  – specify the source data validation procedures
	  – define key points in the process where work product quality is to be measured

Process Management Indicator Table

Level 4 Quantitatively-Controlled

Common Feature 4.2: Objectively Managing Performance

Practice:	**4.2.1**
Determine process capability.	**Determine the process capability of the defined process quantitatively.**
Associated Processes/Practices:	PRO.5.2 Define quality metrics SUP.3 Perform Quality Assurance ORG.3.3 Understand the process
Potential Sources for Existence Evidence	– Goals (12) – Quality strategy/plan (25) – Quality measures(39) – Quality records (28) – Process performance data(18) – Corrective actions (97) – Assessment / audits records (29) – Process management tools – Assessment instrument repository – Historical records

Process Management Indicators	– Process assessment results are available:
	  – results identify capabilities of the defined process
	  – results are stored for future use
	  – results are measured against available benchmarks, target profiles
	– Process measures are used to monitor the process performance at key points in the defined process
	  – quality thresholds established are evaluated against actual performance
	  – measurement trend analysis data is used to determine the process capability results
	– The organization unit measures compliance with the established process tasks activities and the established work product quality characteristics
	  – process adherence is monitored against established criteria and goals
	  – measurement data is available
	  – deviations from established specifications are measured

Process Management Indicator Table

Level 4	Quantitatively-Controlled

Practice:	**4.2.2**
Use process capability.	**Take corrective action as appropriate when the process is not performing within its process capability.**
Associated Processes/Practices:	SUP.4 Perform Problem Resolution. ORG.3 Improve the process
Potential Sources for Existence Evidence	– Corrective action records (97) – Job procedure (4) – Quality goals (12) – Quality strategy/plan(25) – Improvement opportunities (26) – Process measures (38) – Process performance data (16) – Progress status records/report (20) – Meeting minutes (19) – Problem report(84) – Tracking system (98) – Analysis results(21) – Change request(94) – Assessment / audit record(29) – Benchmarking data(43)

Process Management Indicators	– Historical data about the performance of the process is used to identify variation/deviation from defined capability
	– The organizational unit can show evidence that when established goals are not achieved corrective actions are defined:
	  – when goal thresholds are out of bounds, measures / statistical controls show corrective actions are implemented, and effective
	  – when process' capability results do not reach established targets corrective actions are implemented and effective.

Process Management Indicator Table

Level 5 Continuously-Improving

Common Feature 5.1: Improving Organizational Capability

Practice:	**5.1.1**
Establish process effectiveness goals.	**Establish quantitative goals for improving process effectiveness of the standard process family, based on the business goals of the organization and the current process capability.**
Associated Processes/Practices:	CUS.3.2 Understand the customer expectations ORG.1.1 Establish a strategic vision ORG.3 Improve the Process ORG.2.1 Define Goals
Potential Sources for Existence Evidence	– Process measures (38) – Capability assessment results (29) – Business/organizational plans/goals (12) – Quality goals (12) – Improvement opportunities (26) – Corrective action records (97) – Progress status records/report (20) – Process performance data (16) – Meeting minutes (19) – Problem report (84) – Tracking system (98) – Change request (94) – Quality strategy/plan (25) – Benchmarking data (43)

Process Management Indicators	– Current business/organizational goals have been defined
	– Current capability assessment results and/or target profiles are available for the process being reviewed
	– Process capability results and profiles are benchmarked against:
	  – other available data and profiles (industry, internal organizations, historical, etc.)
	  – defined goals (organizational, business, customer expectation)
	  – established target profiles

Process Management Indicator Table

Level 5	Continuously-Improving

Process Management Indicators (continued)	– The goals established reflect:
	  – the known process capability and target capability desired
	  – establishes a target date for when the desired capability will be achieved
	  – identify the potential cost/benefits of planned improvement activities
	– The software process effectiveness goals established:
	  – optimize the relationship between business needs and customer expectations
	  – are achievable within the constraints of the project and allocated resources
	  – are measurable
	– In establishing quantitative goals for improving effectiveness of the software process consideration was given to:
	  – the strategic business goals of the company
	  – the customers expectations/needs
	  – historical process performance measurement results
	  – the factors that impact effectiveness, such as:
	  – *economic factors* (productivity, profit, growth, efficiency, quality, competition, resources, and capacity)
	  – *human factors:* (job satisfaction, motivation, morale, conflict/cohesion, goal consensus, participation, training, span of control)
	  – *management factors:* (skills, commitment, leadership, adaptation, knowledge, ability)
	  – *technology factors:* (sophistication of system, technical expertise, development methodology; organizational process capability, adherence to process)

Process Management Indicator Table

Level 5	**Continuously-Improving**

Practice:	**5.1.2**
Continuously improve the standard process.	**Continuously improve process by changing the organization's standard process family to increase its effectiveness.**
Associated Processes/Practices:	ORG.3 Improve the Process CUS.8 Assess Customer Satisfaction ORG.1.1 Establish a strategic vision CUS.3.2 Understand the customer expectations
Potential Sources for Existence Evidence	– Process measures (38) – Job procedures, practices (4) – Assessment results (29) – Meeting minutes (19) – Goals/objectives: *(effectiveness criteria, business goals)* (12) – Process performance data (18) – Quality measurements (39) – Field measures (41) – Service level measures (42) – Benchmarking data (43) – Process description (3) – Software life cycle model (2) – Waivers to the standard process – Process improvement historical records

Process Management Indicators	– Evidence of potential improvement to the standard processes exists
	– A Process Improvement plan for the organization's standard process exist which:
	  – identifies the scope of the improvement effort
	  – defines the improvement tasks to be performed
	  – defines the ownership for improvement activities
	  – establishes target dates for completion of improvements
	– Change procedures for the standard process exist:
	  – analyzes common causes in variations of the processes used by different organizations
	  – analyzes process waivers and the amount of tailoring required
	  – defines factors to consider in prioritizing changes
	  – contains controls for orderly change and transition

Process Management Indicator Table

Level 5	Continuously-Improving

Process Management Indicators (Continued)	– Process improvement history shows:
	  – on-going changes to the organization's standard process
	  – a decreased need for waivers/tailoring of the standard process
	  – confirmation about the effectiveness of the process changes which were performed
	– Results of corrective actions are monitored against established process measures, and established quality goals to determine if they were effective.
	– Changes initiated are orderly and controlled:
	  – impacts to organization using the standard process family are assessed before changes are implemented
	  – potential changes are evaluated against the defined process effectiveness criteria
	  – pilot testing of change(s) is performed
	  – potential changes are benchmarked against existing process performance and improvement goals desired
	  – effect of potential process change on current development is considered
	  – goals/objectives to be achieved by process change defined
	  – process change results are monitored for effectiveness
	  – the staff is training of on the new process prior to implementation of the change

Process Management Indicator Table

Level 5 Continuously-Improving

Common Feature 5.2: Improving Process Effectiveness

Practice:	**5.2.1**
Perform Causal Analysis.	**Perform causal analysis of defects**
Associated Processes/Practices:	SUP.4 Perform Problem Resolution ORG.3 Improve the Process PRO.5.4 Perform quality activities PRO.5.5 Assess quality ENG.7.2 Analyze user problems and enhancements
Potential Sources for Existence Evidence	– Analysis results (21) – Problem report (84) – Tracking system (98) – Process descriptions (3) – Work breakdown structure(6) – Review plan (16) – Improvement opportunities (26) – Quality records (28) – Corrective action records (97)

Process Management Indicators	– A mechanism(s) to record defects is available
	  – customer found field failures
	  – defects found in testing product
	  – defects in internal work products
	  – process deficiencies
	– A causal analysis process is defined which establishes the criteria for:
	  – the resources needed
	  – the expertise needed
	  – the events that would trigger an analysis
	  – grouping, prioritizing and removing defects
	  – the approach to performing an analysis

Process Management Indicator Table

Level 5	Continuously-Improving

Process Management Indicators (continued)	– Causal analysis results:
	  – identified the place in the life cycle where defects were first introduced
	  – identified process deficiencies associated with common product defects
	  – identified product design deficiencies associated with common product defects
	  – identified corrective actions related to product and process deficiencies
	– Project records show that:
	  – the appropriate expertise was involved in the causal analysis activities
	  – project time was committed to performing the causal analysis
	  – the results of the causal analysis were utilized in process improvement planning

Process Management Indicator Table

Level 5 Continuously-Improving

Practice:	**5.2.2**
Eliminate defect causes.	**Eliminate the causes of defects in the defined process selectively.**
Associated Processes/Practices	SUP.4 Perform problem resolution
Potential Sources for Existence Evidence	– Process descriptions (3) – Work breakdown structure (6) – Corrective action records (97) – Change control records (95)* – Quality improvement plan (25) – Quality records (28) – Review records(31) – Measurement reports (37-43)

Process Management Indicators	– Corrective actions from causal analysis:
	  – are prioritized by established criteria
	  – are implemented in a timely manner
	– Corrective actions implemented are reviewed for effectiveness in solving
	  – process deficiency (inadequate processes, incorrect process)
	  – product defects (faults)
	  – project management deficiencies (staff, resources, time)
	– A mechanism exists to track and measure the improvement associated with process change
	– Corrective actions implemented result in a reduction of defects
	– Corrective actions have associated process improvement plans

Process Management Indicator Table

Level 5 Continuously-Improving

Practice:	**5.2.3**
Continuously improve the defined process.	**Continuously improve process performance by changing the defined process to increase its effectiveness.**
Associated Processes/Practices:	CUS.8 Assess Customer Satisfaction ORG.1.1 Establish a strategic vision ORG.2 Define the Process ORG.3 Improve the Process CUS.3 Identify Customer needs
Potential Sources for Existence Evidence	– Process descriptions (3) – Work breakdown structure (6) – Corrective action records (97) – Change control records (95)* – Quality improvement plan (25) – Improvement opportunities (26) – Quality records (28) – Review records(31) – Measurement reports (37-43) – New process technology analysis – Causal /defect analysis (21) – Process assessment results (29) – process change management procedures (4) – Plans (strategic, improvement, project, etc.) (16) – Process improvement record (28) – Goals, objectives(12) – Effectiveness criteria (27)

Process Management Indicators	– Potential improvement opportunities are identified
	– Process change procedures exist which:
	  – defines the method for identification of potential changes
	  – prioritize changes
	  – contains controls for orderly change and transition
	– Process improvement history shows:
	  – on-going changes to the organization's defined process
	  – confirmation about the effectiveness of the changes performed

Process Management Indicator Table

Level 5	Continuously-Improving

Process Management Indicators (continued)	– Changes initiated are orderly and controlled: – the scope of the improvement effort is defined along with targets dates for completion – ownership for improvement efforts are defined – impacts to organization using the standard process family are assessed – potential changes are evaluated against the defined process effectiveness criteria – pilot testing of change(s) is performed – bench marking potential changes against existing process performance and improvement goals desired – effect of potential process change on current development is considered – goals/objectives to be achieved by process change defined – monitoring of process change results – training of the organization on the new process prior to implementation of the change

Annex B (normative)

Process to work product mapping table

Introduction

The purpose of this table is to help the assessor relate the work products found in an organization to the process in part 2 of this International Standard that impact its creation or subsequent use. This information is helpful when reviewing sample work products of an organizational unit, and assessing the adequacy of the process/practices that created the work product.

Work products are produced by the execution of a series of practices defined in a process. Either this table or the table provided in Annex C can be used to help the assessor or tool builder understand this mapping.

The information in this table is similar to the information provided in the Practice Mapping table provided in Annex C, which maps each practice to the work product. This table just provides a process view of the mapping.

The following information describes the fields in the Process Mapping table which is provided in this Annex.

The process identifier	Provides a direct mapping from the process in part 2 of this International Standard to the associated work product(s).
Potential input work product type	Lists a Work Product identifier, followed by the name of the associated work product which would be *input* to the process. Note: *Each potential input work product has associated characteristics defined in Annex D*
Potential output work product type	Lists a Work Product identifier, followed by the name of the associated work product which would be *output* from the process, updated or created by the practices contained within the process. Note: *Each potential output work product has associated characteristics defined in Annex D*

NOTE: Within this table the symbol "*reference" is used to show the outputs from of another process, as referenced, may be required to understand if this process is adequately implemented. Rather than duplicate the information in that process, a reference is given to the associated process.

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
CUS.1	83) Customer Request 52) *Internal* Requirements 48) Supplier Proposal Response 49) *Supplier* History record 29) Assessment / Audit record	44) Product Needs Assessment 52) *Product / Service* Requirements 45) Acquisition strategy/plan 47) Request for Proposal 21) Analysis Results
CUS.2	51) Contract 21) Analysis Results 45) Acquisition Strategy	31) Review Records 51) Contract
CUS.3	83) Customer Request 52) *Customer* Requirements	83) Customer Request 46) Market Analysis 87) Communication Mechanism
CUS.4	51) Contract 83) Customer Request 12) Business Goals 24) Quality statement or policy 20) Progress Status Report 84) Problem Report 62) Test Results 52) *Customer* Requirements 59) *Acceptance* Test Plan 3) Process Description 12) Business Goals 24) Quality statement or policy 18) Process Performance Data 38) Process Measures	25) Quality strategy/plan 29) Assessment / Audit record 26) Improvement Opportunity 31) Review Records 30) Review strategy/plan
CUS.5	52) *Customer* Requirements 51) Contract 106) Customer Documentation 73) System	74) Installation Plan 75) Installation Guide 71) Release Notes 78) Delivery instructions 107) Installation Record 76) Packaging Record 70) Release Package 79) Delivery Record 81) Acceptance Record 80) Handling and Storage Guide
CUS.6	84) Problem Report 42) Service Level Measures 41) Field Measures 59) Test Plan 60) Test Script 61) Test Case 73) System 4) Job Procedures 83) Customer Request	22) Risk Analysis 62) Test Results 94) Change Request 42) Service Level Measures 99) Work-around 84) Problem Report 87) Communication Mechanism

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
CUS.7	51) Contract 52) Requirements Specification 52) *Customer* Requirements 41) Field Measures 84) Problem Reports	89) Training Records 87) Communication Mechanism 42) Service Level Measures
CUS.8	85) Customer Satisfaction Survey 41) Field Measures 31) Review records 82) Competitor Information	86) Customer Satisfaction Data 43) Benchmarking Data 87) Communication Mechanism
ENG.1	52) *Customer* Requirements 52) *Maintenance* Requirements 44) Product Needs Assessment 83) Customer Request 94) Change Request 46) Market Analysis	52) *System* Requirements 100) Product Configuration _ 53) System Design / Architecture _ 101) Database Design 58) Traceability record/mapping _ 69) Release strategy /plan
ENG.2	52) *Customer* Requirements 52) *Maintenance* Requirements 44) Product Needs Assessment 83) Customer Request 94) Change Request 53) System Design / Architecture 84) Problem Reports 87) Communication Mechanism	52) *Software* Requirements _ 21) Analysis Results 52) *System* Requirements _ 31) Review records 19) Meeting Minutes 87) Communication Mechanism
ENG.3	52) *Software* Requirements 53) System Design / Architecture	54) High Level Software Design 55) Low Level Software Design 58) Traceability record/mapping
ENG.4	55) Low Level Software Design 101) Database Design 35) Reuse Repository 10) Coding Standards 52) *Software* Requirements 52) *System* Requirements	56) Software units (code) 59) Test Plan 60) *Unit* Test Script 61) Test Case 62) Test Results
ENG.5	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 95) Change Control 54) High Level Software Design 55) Low Level Software Design 53) System Design / Architecture 56) Software units (code) 69) Release strategy /plan	67) Regression Test Strategy 58) Traceability record/mapping 57) Build Lists 65) Integration Test strategy/plan 60) *Integration* Test Script 64) *Software* Test plan 60) *Software* Test Script 61) Test Case 62) Test Results 72) Integrated Software

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
ENG.6	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design 69) Release strategy /plan 108) System Components	57) Build Lists 65) Integration Test strategy/plan 58) Traceability record/mapping 60) *Integration* Test Script 61) Test Case 62) Test Results 66) *System* Test plan 60) *System* Test Script 73) System
ENG.7	52) *Customer* Requirements 83) Customer Request 84) Problem Reports 53) System Design / Architecture 94) Change Request 34) Testing Strategy 67) Regression Test Strategy 95) Change Control	52) *Maintenance* Requirements 21) Analysis Results 95) Change Control record 69) Release strategy /plan _ *Reference. ENG.1, ENG.2, ENG.3, ENG.4, ENG.5, ENG.6, SUP.1, CUS.5, CUS.6, CUS.7, CUS.8
PRO.1	52) *Customer* Requirements 12) Business Goals 22) Risk Analysis 24) Quality Statement / Policy 51) Contract	21) Analysis Results 2) Life Cycle Models 3) Process Description 6) Work Breakdown Structures 25) Quality strategy/plan 30) Review strategy/plan 1) Software Development Methodology
PRO.2	1) Software Development Methodology 52) *Customer* Requirements 12) Business Goals 24) Quality Statement / Policy 33) Reuse Strategy 32) Reuse Plan 35) Reuse Repository 49) Subcontractor or supplier database 25) Quality strategy/plan 2) Life Cycle Models 30) Review strategy/plan	6) Work Breakdown Structure 17) Project Plan _ 9) Standards 10) Coding Standards 104) Development Environment 33) *Projects* Reuse Strategy 11) Estimates 22) Risk Analysis 23) Risk Management Plan 37) Project Measures 5) Schedule 50) Commitment / Agreements
PRO.3	17) Project Plan 89) Training records	4) Job Procedure 14) Policies 87) Communication Mechanism 90) Training Material 50) Commitment / Agreements 119) Meeting Minutes

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
PRO.4	83) Customer Request 21) Analysis Results 22) Risk Analysis record 96) Change History 51) Contract 52) Customer Requirements 6) Work breakdown structure	50) Commitment / Agreements 52) Customer Requirements 51) Contract 95) Change Control 96) Change History 87) Communication Mechanism 58) Traceability record/mapping *Reference: PRO.2, ENG.1, ENG.2, ENG.5, ENG.6, ENG.7, PRO.1
PRO.5	52) Customer Requirements 17) Project Plan 16) Business Plan 24) Quality Statement/Policy 25) Quality Plan 6) Work Break Down Structure	12) Goals (Quality) 25) Quality Plan _ 17) Project Plan _ 25) Quality strategy/plan 39) Quality Measures 6) Work Break Down Structure 18) Process Performance data 97) Corrective Actions
PRO.6	17) Project Plan 12) *Business* Goals 12) *Quality* Goals 1) Software Development Methodology 23) Risk Management strategy/plan 52) *Customer* Requirements 49) Subcontractor or supplier database 11) Estimates 25) Quality strategy/plan 59) Test Plan 74) Installation Plan 37) Project Measures 38) Process Measures 39) Quality Measures 41) Field Measures 42) Service Level Measures 86) Customer Satisfaction Data 31) Review Records 29) Assessment / Audit record 5) Schedule	22) Risk Analysis 40) Risk Measures 23) Risk Management strategy/plan 18) Process Performance data 29) Assessment / Audit Records 97) Corrective Actions *Note: Risk Management strategy / plan could be included as a part of any of the following:* 17) Project Plan 25) Quality strategy/plan 16) Business Plan 45) Acquisition strategy/plan 59) Test Plan (updated as appropriate)

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
PRO.7	17) Project plan 6) Work Breakdown Structure 11) Estimates 5) Schedule 50) Commitment /Agreements 51) Contract 37) Project Measures 30) Review plan 23) Risk Management Plan 25) Quality plan 16) Business plan 45) Acquisition strategy/plan 59) Test plan 52) Requirements	20) Progress Status 31) Review records 29) Assessment / audit record 97) Corrective Actions
PRO.8	17) Project plan 6) Work Breakdown Structure 45) Acquisition strategy/plan 52) *Subcontractor* Requirements 49) *Subcontractor* History record 48) Supplier Proposal Response 25) Quality strategy/plan 39) Quality Measures 27) Quality Criteria 30) Review plan 37) Project Measures 23) Risk Management strategy/plan* 40) Risk Measures 87) Communication Mechanism 18) Process Performance data 59) *Acceptance* Test Plan 51) Contract	*Reference CUS.1 47) Request for Proposal 29) Assessment / Audit record 21) Analysis Results 51) Contract 50) Commitments / Agreements 31) Review records 97) Corrective Actions 26) Improvement Opportunity 87) Communication Mechanism 81) Acceptance Record
SUP.1	52) *Customer* Requirements 83) Customer Request 53) System Design / Architecture 44) Product Needs Assessment 3) Process Description 30) Review plan 59) Test Plan 60) Test Script 61) Test Case 77) Distribution List 78) Delivery Instructions 84) Problem Reports 52) *Maintenance* Requirements 94) Change Request	52) *Documentation* Requirements 18) Process Performance data 106) Customer Documentation 31) Review records 62) Test Results 79) Delivery record 81) Acceptance record 95) Change Control 96) Change History

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
SUP.2	93) Configuration Item 94) Change Request 69) Release strategy /plan	92) Configuration Management (file, library, system) 93) Configuration Item 95) Change Control 57) Build Lists 72) Integrated Software 73) System 70) Release Package 96) Change History 20) Progress Status record / report
SUP.3	52) Requirements 1) Software Development Methodology 38) Process Measures 39) Quality Measures 17) Project plan 25) Quality strategy/plan 30) Review strategy/plan 37) Project Measures 27) Quality Criteria	9) Standards 10) Coding Standards 44) Product Needs Assessment 31) Review records 29) Assessment / Audit record 20) Progress Status record / report 19) Meeting minutes 97) Corrective Actions
SUP.4	83) Customer Request 31) Review Records 84) Problem Report * References: CUS.4.3, CUS.4.5, CUS.6.5, CUS.6.6, CUS,7.3 CUS.7.4, CUS.7.5, ENG5.4, ENG5.6, ENG.6.3, ENG.6.5, ENG.7.2, SUP.3.6, SUP.5.7	84) Problem Report 98) Tracking system 21) Analysis Results 97) Corrective Actions 94) Change Request 69) Release strategy /plan 52) *Maintenance* Requirements 95) Change Control 6) Work Breakdown Structure 17) Project Plan * References:ORG.3, ENG.7, CUS.5
SUP.5	17) Project plan 6) Work Breakdown Structures 25) Quality strategy/plan 1) Software Development Methodology 9) Standards 10) Coding Standards 52) Requirements 27) Quality Criteria	30) Review strategy/plan 77) Distribution list 31) Review Records 97) Corrective Actions

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
ORG.1	12) *Business* Goals 17) Project Plan	13) Vision 14) Policies 87) Communication Mechanism 19) Meeting Minutes 17) Project Plan 4) Job Procedure 86) Customer Satisfaction Data 25) Quality strategy/plan _ 15) Personnel Policies 89) Training records
ORG.2	12) *Business* Goals 13) Vision 14) Policies 1) Software Development Methodology 2) Life Cycle Models 24) Quality Statement or Policy 52) *Product* / *Service* Requirements 9) Standards 39) Quality Measures	12) *Process* Goals 3) Process Description 6) Work Breakdown Structures 4) Job Procedure 7) Work Products 27) Quality Criteria 30) Review strategy/plan 8) Interfaces 38) Process Measures 17) Project plan 87) Communication Mechanism 77) Distribution List 89) Training records 28) Quality records
ORG.3	52) Requirements 9) Standards 44) Product Needs Assessment 51) Contract 29) Assessment / Audit record 97) Corrective Actions 21) Analysis Results 31) Review Records 83) Customer Request 46) Market Analysis 12) Business Goals 84) Problem Report 18) Process Performance Data 86) Customer Satisfaction Data 22) Risk Analysis 43) Benchmarking Data 38) Process Measures 39) Quality Measures 42) Service Level Measures 3) Process Description 12) *Process* Goals 27) Quality Criteria	26) Improvement Opportunity 25) Quality strategy/plan 29) Assessment / Audit record 38) Process Measures 43) Benchmarking data 3) Process Description 17) Project plan 87) Communication mechanism 77) Distribution list 89) Training records

Process to Work Product Mapping Table

Process	Input work product type	Output work product type
ORG.4	89) Training records 44) Product Needs Assessment 6) Work Breakdown Structures 23) Risk Management 17) Project Plan 16) Business Plan 4) Job Procedures, Practices 9) Standards 15) Personnel Policies	88) Training strategy/plan 89) Training records 9) Training Material
ORG.5	1) Software Development Methodology 2) Life Cycle Models 12) Business Goals 7) any Work Products (i.e., designs, code, architecture, tests, etc.) 14) Policies 9) Standards 23) Risk Management 17) Project Plan 16) Business Plan 94) Change Request 84) Problem Reports 95) Change Control 52) *Maintenance* Requirements	33) Reuse Strategy 32) Reuse Plan 9) Standards 34) Reusable Object 35) Reuse Repository 95) Change Control 31) Review Records 1) Software Development Methodology 2) Life Cycle Models 3) Process Description *Reference: ENG.3, ENG.4, ENG.5, ENG.6, ENG.7, SUP.1
ORG.6	44) Product Needs Assessment 94) Change Request 84) Problem Reports 95) Change Control 52) *Maintenance* Requirements	52) *Environment* Requirements 17) Project Plan 104) Development Environment * References: CUS.6, CUS.7, ENG.7
ORG.7	52) *Environment* Requirements 17) Project plan 25) Quality strategy/plan	104) Development Environment 103) Recovery plan 102) Backup/recovery records * Reference: ORG.6

Annex C (normative)

Base practice to work product mapping table

Introduction

The purpose of this base practice to work product mapping table is to help the assessor or tool builder relate work products and their defined characteristics to the practices in part 2 of this International Standard which impact their creation or subsequent use.

The fields in the base practice to work product mapping table contain the following information.

Base practice identifier:	Provides a direct mapping from the base practice in part 3 of this International Standard to the associated work product(s).
Potential input work product type:	Lists a work product identifier, followed by the name of the associated work product which would be *input* to the process or practice. Each *input work product has associated characteristics defined in Annex D*
Potential output work product type	Lists a work product identifier, followed by the name of the associated work product which would be *output* from the practice. *Each output work product has associated characteristics defined in Annex D*

NOTE: Within this table several symbols are used as follows:

(1) The symbol Δ is used to imply that the work product is built incrementally from the execution of several practices, or processes. Each practice may add a piece of information to the eventual output work product. When looking at these work products the assessor will need to judge the adequacy of the practices that produced the work product. Sometimes the adequacy of these practices can not be viewed in isolation, but rather should be viewed in how they contribute to achieving the purpose of the process. The work products produced and their usefulness to achieving the process purpose help determine this judgement.

(2) The symbol "*reference" is used to show that one actually may need to look at the outputs from a whole process as referenced to understand if this practice is adequately implemented. Rather than duplicate the information in that process, a reference is given to the associated process.

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
CUS.1.1	83) Customer Request 52) *Internal* Requirements	44) Product Needs Assessment
CUS.1.2	44) Product Needs Assessment	52) *Product* / *Service* Requirements
CUS.1.3	52) *Product* / *Service* Requirements	45) Acquisition strategy/plan
CUS.1.4	52) *Product* / *Service* Requirements 45) Acquisition strategy/plan	47) Request for Proposal
CUS.1.5	48) Supplier Proposal Response 49) *Supplier* History record 29) Assessment / Audit record	21) Analysis Results
CUS.2.1	51) Contract	31) Review Records
CUS.2.2	51) Contract 21) Analysis Results	51) Contract
CUS.2.3	45) Acquisition Strategy 21) Analysis Results	51) Contract
CUS.2.4	45) Acquisition Strategy 21) Analysis Results	51) Contract
CUS.3.1	83) Customer Request	83) Customer Request 46) Market Analysis
CUS.3.2	83) Customer Request 46) Market Analysis 52) *Customer* Requirements	83) Customer Request 46) Market Analysis
CUS.3.3	83) Customer Request	87) Communication Mechanism
CUS.4.1	51) Contract 83) Customer Request 12) Business Goals 24) Quality statement or policy	25) Quality strategy/plan
CUS.4.2	25) Quality strategy/plan	30) Review strategy/plan
CUS.4.3	20) Progress Status Report 30) Review strategy/plan	31) Review Records
CUS.4.4	84) Problem Report 62) Test Results 83) Customer Request 30) Review strategy/plan	31) Review Records

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
CUS.4.5	52) *Customer* Requirements 59) *Acceptance* Test Plan	31) Review Records
CUS.4.6	3) Process Description 12) Business Goals 24) Quality statement or policy 18) Process Performance Data 38) Process Measures	29) Assessment / Audit record 26) Improvement Opportunity
CUS.5.1	52) *Customer* Requirements 51) Contract	74) Installation Plan 75) Installation Guide 71) Release Notes 78) Delivery instructions
CUS.5.2	74) Installation Plan	107) Installation Record
CUS.5.3	74) Installation Plan 106) Customer Documentation 71) Release Notes 73) System	76) Packaging Record 70) Release Package
CUS.5.4	74) Installation Plan 78) Delivery instructions 70) Release Package	79) Delivery Record
CUS.5.5	70) Release Package 79) Delivery Record 78) Delivery instructions	81) Acceptance Record
CUS.5.6	74) Installation Plan 75) Installation Guide 70) Release Package	81) Acceptance Record
CUS.5.7	74) Installation Plan	80) Handling and Storage Guide
CUS.6.1	84) Problem Report 42) Service Level Measures 41) Field Measures	22) Risk Analysis
CUS.6.2	59) Test Plan 60) Test Script 61) Test Case	62) Test Results
CUS.6.3	4) Job Procedures	none
CUS.6.4	84) Problem Report 73) System	94) Change Request * Reference SUP.4
CUS.6.5	83) Customer Request	84) Problem Report 87) Communication Mechanism

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
CUS.6.6	84) Problem Report	99) Work-around
CUS.6.7	73) System	42) Service Level Measures
CUS.7.1	51) Contract 52) Requirements Specification	89) Training Records
CUS.7.2	51) Contract 52) *Customer* Requirements	87) Communication Mechanism
CUS.7.3	41) Field Measures 84) Problem Reports	42) Service Level Measures
CUS.7.4	51) Contract 52) *Customer* Requirements	*Reference: ENG.7 and CUS.5
CUS.8.1	85) Customer Satisfaction Survey 41) Field Measures 31) Review records	86) Customer Satisfaction Data
CUS.8.2	86) Customer Satisfaction Data 82) Competitor Information	43) Benchmarking Data
CUS.8.3	86) Customer Satisfaction Data 43) Benchmarking Data	87) Communication Mechanism
ENG.1.1	52) *Customer* Requirements 52) *Maintenance* Requirements 44) Product Needs Assessment 83) Customer Request 94) Change Request	52) *System* Requirements
ENG.1.2	52) *System* Requirements	100) Product Configuration Δ 53) System Design / Architecture Δ
ENG.1.3	52) *System* Requirements 53) System Design / Architecture	100) Product Configuration 101) Database Design 53) System Design / Architecture Δ 58) Traceability record/mapping Δ
ENG.1.4	52) *System* Requirements 44) Product Needs Assessment 83) Customer Request 94) Change Request 46) Market Analysis	69) Release strategy /plan

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ENG.2.1	52) *Customer* Requirements 52) *Maintenance* Requirements 44) Product Needs Assessment 83) Customer Request 94) Change Request 53) System Design / Architecture	52) *Software* Requirements
ENG.2.2	52) *Software* Requirements 44) Product Needs Assessment 83) Customer Request 53) System Design / Architecture	21) Analysis Results 52) *Software* Requirements Δ
ENG.2.3	52) *Software* Requirements 53) System Design / Architecture	21) Analysis Results 52) *System* Requirements Δ 52) *Software* Requirements Δ
ENG.2.4	52) *Software* Requirements	31) Review records 19) Meeting Minutes 87) Communication Mechanism 52) *Software* Requirements Δ
ENG.2.5	52) *Software* Requirements 84) Problem Reports 83) Customer Request 87) Communication Mechanism	52) *Software* Requirements Δ
ENG.3.1	52) *Software* Requirements 53) System Design / Architecture	54) High Level Software Design Δ
ENG.3.2	54) High Level Software Design 52) *Software* Requirements 53) System Design / Architecture	54) High Level Software Design Δ
ENG.3.3	54) High Level Software Design	55) Low Level Software Design
ENG.3.4	52) *Software* Requirements 54) High Level Software Design 55) Low Level Software Design	58) Traceability record/mapping
ENG.4.1	55) Low Level Software Design 101) Database Design 35) Reuse Repository 10) Coding Standards	56) Software units (code)
ENG.4.2	55) Low Level Software Design 52) *Software* Requirements 52) *System* Requirements	59) Test Plan 60) *Unit* Test Script 61) Test Case

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ENG.4.3	59) Test Plan 60) *Unit* Test Script 61) Test Case 56) Software units (code)	62) Test Results
ENG.5.1	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 95) Change Control	67) Regression Test Strategy 58) Traceability record/mapping
ENG.5.2	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design 69) Release strategy /plan	57) Build Lists 65) Integration Test strategy/plan 58) Traceability record/mapping
ENG.5.3	57) Build Lists 65) Integration Test strategy/plan 52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design	60) *Integration* Test Script 61) Test Case
ENG.5.4	65) Integration Test strategy/plan 60) *Integration* Test Script 61) Test Case 56) Software units (code)	62) Test Results
ENG.5.5	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design	58) Traceability record/mapping 64) *Software* Test plan 60) *Software* Test Script 61) Test Case
ENG.5.6	64) *Software* Test plan 60) *Software* Test Script 61) Test Case 72) Integrated Software	62) Test Results

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ENG.6.1	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design 69) Release strategy /plan 108) System Components	57) Build Lists 65) Integration Test strategy/plan 58) Traceability record/mapping
ENG.6.2	57) Build Lists 65) Integration Test strategy/plan 52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design	60) *Integration* Test Script 61) Test Case
ENG.6.3	60) *Integration* Test Script 61) Test Case	62) Test Results
ENG.6.4	52) *System* Requirements 52) *Software* Requirements 52) *Maintenance* Requirements 53) System Design / Architecture 54) High Level Software Design 55) Low Level Software Design	66) *System* Test plan 60) *System* Test Script 61) Test Case
ENG.6.5	60) *System* Test Script 61) Test Case 73) System	62) Test Results
ENG.7.1	52) *Customer* Requirements 83) Customer Request 84) Problem Reports 53) System Design / Architecture	52) *Maintenance* Requirements
ENG.7.2	52) *Maintenance* Requirements 83) Customer Request 84) Problem Reports 53) System Design / Architecture	21) Analysis Results
ENG.7.3	21) Analysis Results 83) Customer Request 94) Change Request 84) Problem Reports 34) Testing Strategy 67) Regression Test Strategy	95) Change Control record 69) Release strategy /plan Δ 52) *Maintenance* Requirements
ENG.7.4	95) Change Control 52) *Maintenance* Requirements	*Reference: ENG.1, ENG.2, ENG.3, ENG.4, ENG.5, ENG.6, SUP.1

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ENG.7.5	95) Change Control 52) *Maintenance* Requirements	*Reference: CUS.5, CUS.6, CUS.7, CUS.8, SUP.1
PRO.1.1	51) Contract 52) *Customer* Requirements 12) Business Goals 22) Risk Analysis 24) Quality Statement / Policy	21) Analysis Results
PRO.1.2	52) *Customer* Requirements 12) Business Goals 22) Risk Analysis 24) Quality Statement / Policy	2) Life Cycle Models
PRO1.3	2) Life Cycle Models 21) Analysis Results 52) *Customer* Requirements 12) Business Goals 24) Quality Statement / Policy 22) Risk Analysis	3) Process Description 6) Work Breakdown Structures
PRO.1.4	2) Life Cycle Models 3) Process Description 6) Work Breakdown Structure 21) Analysis Results 52) *Customer* Requirements 12) Business Goals 24) Quality Statement / Policy 22) Risk Analysis 24) Quality Statement / Policy	3) Process Description 6) Work Breakdown Structure 25) Quality strategy/plan 30) Review strategy/plan
PRO.1.5	2) Life Cycle Models 3) Process Description 6) Work Breakdown Structure 21) Analysis Results 52) *Customer* Requirements 12) Business Goals 22) Risk Analysis	1) Software Development Methodology
PRO.2.1	1) Software Development Methodology 52) *Customer* Requirements 12) Business Goals 24) Quality Statement / Policy	6) Work Breakdown Structure 17) Project Plan Δ
PRO.2.2	52) *Customer* Requirements 12) Business Goals 24) Quality Statement / Policy	9) Standards 10) Coding Standards 17) Project Plan Δ
PRO.2.3	52) *Customer* Requirements 12) Business Goals	104) Development Environment 17) Project Plan Δ

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
PRO.2.4	33) Reuse Strategy 32) Reuse Plan 35) Reuse Repository 1) Software Development Methodology 52) *Customer* Requirements	33) *Projects* Reuse Strategy 17) Project Plan Δ
PRO.2.5	52) *Customer* Requirements 12) Business Goals	11) Estimates 17) Project Plan Δ
PRO.2.6	52) *Customer* Requirements 12) Business Goals 49) Subcontractor or supplier database	22) Risk Analysis 23) Risk Management 17) Project Plan Δ
PRO.2.7	6) Work Breakdown Structure 17) Project Plan 1) Software Development Methodology 52) *Customer* Requirements 52) *Customer* Requirements 12) Business Goals 49) Subcontractor or supplier database 11) Estimates 23) Risk Management Plan 25) Quality strategy/plan	37) Project Measures 17) Project Plan Δ
PRO.2.8	6) Work Breakdown Structure 17) Project Plan Δ 1) Software Development Methodology 2) Life Cycle Models 23) Risk Management Plan 52) *Customer* Requirements 11) Estimates	5) Schedule 17) Project Plan Δ
PRO.2.9	52) *Customer* Requirements 17) Project Plan 11) Estimates 5) Schedule 6) Work Breakdown Structure 25) Quality strategy/plan 30) Review strategy/plan	50) Commitment / Agreements 17) Project Plan Δ
PRO2.10	6) Work Breakdown Structure 17) Project Plan Δ 1) Software Development Methodology 2) Life Cycle Models 23) Risk Management Plan 52) *Customer* Requirements 11) Estimates	17) Project Plan

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
PRO.3.1	17) Project Plan 89) Training records	4) Job Procedure 14) Policies
PRO.3.2	89) Training records	87) Communication Mechanism 90) Training Material 14) Policies
PRO.3.3	17) Project Plan	50) Commitment / Agreements 19) Meeting Minutes
PRO.3.4	17) Project Plan	17) Project Plan 19) Meeting Minutes
PRO.4.1	83) Customer Request 21) Analysis Results 22) Risk Analysis record	50) Commitment / Agreements / Agreements
PRO.4.2	83) Customer Request 21) Analysis Results 22) Risk Analysis record	52) Customer Requirements 51) Contract
PRO.4.3	51) Contract 52) Customer Requirements 83) Customer Request 96) Change History 21) Analysis Results 22) Risk Analysis record	95) Change Control 96) Change History 52) Customer Requirements 87) Communication Mechanism
PRO.4.4	52) Customer Requirements	*Reference: PRO.2,ENG.1,ENG.2,ENG.5 ENG.6, ENG.7, PRO.1
PRO.4.5	52) Customer Requirements 6) Work breakdown structure	58) Traceability record/mapping
PRO.5.1	52) Customer Requirements 17) Project Plan 16) Business Plan 24) Quality Statement/Policy 25) Quality Plan	12) Quality Goals 25) Quality Plan Δ 17) Project Plan Δ
PRO.5.2	52) Customer Requirements 17) Project Plan 16) Business Plan 6) Work Break Down Structure 25) Quality Plan 24) Quality Statement/Policy	25) Quality strategy/plan Δ 39) Quality Measures 17) Project Plan Δ

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
PRO.5.3	52) Customer Requirements 17) Project Plan 16) Business Plan 6) Work Break Down Structure 25) Quality Plan 24) Quality Statement/Policy	25) Quality Plan Δ 17) Project Plan Δ 6) Work Break Down Structure Δ
PRO.5.4	25) Quality Plan 24) Quality Statement/Policy 17) Project Plan Δ	18) Process Performance data 17) Project Plan Δ
PRO.5.5	39) Quality Measures 25) Quality Plan Δ 24) Quality Statement/Policy 12) *Quality* Goals 17) Project Plan Δ	18) Process Performance data 17) Project Plan Δ
PRO.5.6	25) Quality Plan Δ 24) Quality Statement/Policy	97) Corrective Actions (update as appropriate) 25) Quality Plan Δ 17) Project Plan Δ
PRO.6.1	17) Project Plan 12) *Business* Goals 12) *Quality* Goals 1) Software Development Methodology 23) Risk Management strategy/plan 52) *Customer* Requirements 49) Subcontractor or supplier database 11) Estimates 25) Quality strategy/plan 59) Test Plan 74) Installation Plan	23) Risk Management strategy/plan Δ *Note: Risk Management strategy / plan could be included as a part of any of the following:* 17) Project Plan Δ 25) Quality strategy/plan Δ 16) Business Plan Δ 45) Acquisition strategy/plan Δ 59) Test Plan Δ
PRO.6.2	23) Risk Management strategy/plan 37) Project Measures 38) Process Measures 39) Quality Measures 41) Field Measures 42) Service Level Measures 86) Customer Satisfaction Data 31) Review Records 29) Assessment / Audit record 5) Schedule	22) Risk Analysis Δ 23) Risk Management Plan* Δ

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
PRO.6.3	37) Project Measures 38) Process Measures 5) Schedule 17) Project Plan 23) Risk Management strategy/plan 39) Quality Measures 12) Goals (Quality) 25) Quality strategy/plan	22) Risk Analysis Δ 23) Risk Management strategy/plan Δ
PRO.6.4	22) Risk Analysis	23) Risk Management strategy/plan Δ
PRO.6.5	23) Risk Management strategy/plan	40) Risk Measures Δ
PRO.6.6	23) Risk Management strategy/plan	40) Risk Measures Δ 18) Process Performance data
PRO.6.7	23) Risk Management strategy/plan 40) Risk Measures	40) Risk Measures Δ 29) Assessment / Audit Records
PRO.6.8	29) Assessment / Audit Records	97) Corrective Actions (updated as appropriate) 17) Project Plan Δ 25) Quality strategy/plan Δ 16) Business Plan Δ 45) Acquisition strategy/plan Δ 59) Test Plan Δ
PRO.7.1	17) Project Plan 6) Work Breakdown Structure 11) Estimates 5) Schedule 50) Commitment /Agreements 51) Contract	20) Progress Status
PRO.7.2	37) Project Measures	20) Progress Status
PRO.7.3	30) Review plan 23) Risk Management Plan 5) Schedule 17) Project plan 25) Quality plan 16) Business plan 45) Acquisition strategy/plan 59) Test plan 6) Work Breakdown Structure 52) Requirements	31) Review records 29) Assessment / Audit record 97) Corrective Actions

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
PRO.7.4	30) Review plan 23) Risk Management Plan 5) Schedule 17) Project plan 25) Quality plan 45) Acquisition strategy/plan 59) Test plan 6) Work Breakdown Structure 52) Requirements	31) Review records 29) Assessment / Audit record 97) Corrective Actions
PRO.7.5	51) Contract 50) Commitment / Agreements	31) Review records 29) Assessment / Audit record 97) Corrective Actions
PRO.8.1	17) Project plan 6) Work Breakdown Structure 52) Requirements 45) Acquisition strategy/plan	*Reference CUS.1 47) Request for Proposal
PRO.8.2	52) *Subcontractor* Requirements 47) Request for Proposal	29) Assessment / Audit record
PRO.8.3	49) *Subcontractor* History record 29) Assessment / Audit record 48) Supplier Proposal Response	* Reference CUS.1 21) Analysis Results 51) Contract 50) Commitments / Agreements
PRO.8.4	50) Commitments / Agreements 51) Contract 25) Quality strategy/plan 39) Quality Measures 30) Review plan 17) Project Plan 37) Project Measures 23) Risk Management strategy/plan* 40) Risk Measures	50) Commitments / Agreements 51) Contract 31) Review records 29) Assessment / Audit record 97) Corrective Actions 26) Improvement Opportunity
PRO.8.5	87) Communication Mechanism	87) Communication Mechanism
PRO.8.6	51) Contract 52) *Subcontractor* Requirements 17) Project Plan 25) Quality strategy/plan 27) Quality Criteria 39) Quality Measures 18) Process Performance data 38) Process Measures	31) Review records 29) Assessment / audit record 97) Corrective Actions

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
PRO.8.7	59) *Acceptance* Test Plan 17) Project Plan 30) Review strategy/plan 25) Quality strategy/plan 27) Quality Criteria 39) Quality Measures 52) *Subcontractor* Requirements 51) Contract	81) Acceptance Record 31) Review records 29) Assessment / Audit record 97) Corrective Actions
SUP.1.1	52) *Customer* Requirements 83) Customer Request 53) System Design / Architecture 44) Product Needs Assessment 3) Process Description Δ	52) *Documentation* Requirements
SUP.1.2	52) *Documentation* Requirements	18) Process Performance data 106) Customer Documentation
SUP.1.3	52) *Customer* Requirements 52) *Documentation* Requirements 53) System Design / Architecture 3) Process Description Δ 30) Review plan 59) Test Plan 60) Test Script 61) Test Case	31) Review records 62) Test Results
SUP.1.4	106) Customer Documentation 77) Distribution List 78) Delivery Instructions	*Reference CUS.5 79) Delivery Record 81) Acceptance Record
SUP.1.5	83) Customer Request 84) Problem Reports 52) *Documentation* Requirements 52) *Maintenance* Requirements 94) Change Request	*Reference: SUP.1, SUP.2, ENG.7 106) Customer Documentation Δ 95) Change Control 96) Change History
SUP.2.1	93) Configuration Item	92) Configuration Management (file, library, system)
SUP.2.2	94) Change Request 69) Release strategy /plan	92) Configuration Management (file, library, system) 93) Configuration Item
SUP.2.3	93) Configuration Item	92) Configuration Management (file, library, system)
SUP.2.4	94) Change Request	95) Change Control
SUP.2.5	94) Change Request 69) Release strategy /plan	95) Change Control 57) Build Lists

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
SUP.2.6	95) Change Control 57) Build Lists 69) Release strategy /plan 92) Configuration Management (file, library, system)	72) Integrated Software 73) System 70) Release Package
SUP.2.7	95) Change Control 92) Configuration Management (file, library, system)	96) Change History
SUP.2.8	95) Change Control	20) Progress Status record / report
SUP.3.1	52) Requirements 1) Software Development Methodology	9) Standards 10) Coding Standards 44) Product Needs Assessment
SUP.3.2	1) Software Development Methodology 9) Standards 10) Coding Standards 52) Requirements 38) Process Measures 39) Quality Measures 17) Project Plan 25) Quality strategy/plan 30) Review strategy/plan	31) Review Records 29) Assessment / Audit record
SUP.3.3	1) Software Development Methodology 9) Standards 10) Coding Standards 52) Requirements 37) Project Measures 38) Process Measures 39) Quality Measures 25) Quality strategy/plan 27) Quality Criteria 17) Project Plan 30) Review strategy/plan	31) Review Records 29) Assessment / Audit record
SUP.3.4	17) Project Plan 25) Quality strategy/plan	20) Progress Status record / report 19) Meeting Minutes
SUP.3.5	31) Review Records 29) Assessment / Audit record	97) Corrective Actions

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
SUP.4.1	83) Customer Request 31) Review Records * References: CUS.4.3, CUS.4.5, CUS.6.5, CUS.6.6, CUS.7.3, CUS.7.4, CUS.7.5, ENG5.4, ENG5.6, ENG.6.3, ENG.6.5, ENG.7.2, SUP.3.6, SUP.5.7	84) Problem Report Δ
SUP.4.2	84) Problem Report	98) Tracking system
SUP.4.3	84) Problem Report	21) Analysis Results 84) Problem Report Δ
SUP.4.4	21) Analysis Results	84) Problem Report Δ 97) Corrective Actions 94) Change Request 69) Release strategy /plan 52) *Maintenance* Requirements
SUP.4.5	94) Change Request 69) Release strategy /plan 52) *Maintenance* Requirements 97) Corrective Actions	95) Change Control 6) Work Breakdown Structure 17) Project Plan Δ * Reference: ORG.3, ENG.7
SUP.4.6	95) Change Control	* Reference: ORG.3, ENG.7, CUS.5
SUP.5.1	17) Project Plan 6) Work Breakdown Structures 25) Quality strategy/plan	30) Review strategy/plan Δ
SUP.5.2	1) Software Development Methodology 9) Standards 10) Coding Standards 52) Requirements	30) Review strategy/plan Δ
SUP.5.3	27) Quality Criteria	30) Review strategy/plan Δ
SUP.5.4	27) Quality Criteria	30) Review strategy/plan Δ
SUP.5.5	30) Review strategy/plan	77) Distribution list
SUP.5.6	30) Review strategy/plan	31) Review Records Δ
SUP.5.7	31) Review Records Δ	31) Review Records Δ 97) Corrective Actions Δ
SUP.5.8	31) Review Records 97) Corrective Actions	31) Review Records Δ 97) Corrective Actions Δ

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ORG.1.1	12) *Business* Goals	13) Vision 14) Policies
ORG.1.2	13) Vision	87) Communication Mechanism 19) Meeting Minutes 17) Project Plan 4) Job Procedure
ORG.1.3	12) *Business* Goals	86) Customer Satisfaction Data 25) Quality strategy/plan Δ 4) Job Procedure
ORG.1.4	17) Project Plan	* Reference: PRO.3
ORG.1.5	17) Project Plan	14) Policies 15) Personnel Policies
ORG.1.6	17) Project Plan	15) Personnel Policies 89) Training records
ORG.2.1	12) *Business* Goals 13) Vision 14) Policies 1) Software Development Methodology 2) Life Cycle Models	12) *Process* Goals
ORG.2.2	12) *Process* Goals 1) Software Development Methodology 2) Life Cycle Models	3) Process Description Δ 6) Work Breakdown Structure 4) Job Procedure
ORG.2.3	12) *Process* Goals 1) Software Development Methodology 2) Life Cycle Models	3) Process Description Δ 7) Work Products
ORG.2.4	12) *Process* Goals 24) Quality statement or policy 1) Software Development Methodology 2) Life Cycle Models	3) Process Description Δ 27) Quality Criteria
ORG.2.5	12) *Process* Goals 24) Quality statement or policy 1) Software Development Methodology 2) Life Cycle Models	3) Process Description Δ 30) Review strategy/plan 27) Quality Criteria

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ORG.2.6	3) Process Description 1) Software Development Methodology 2) Life Cycle Models	3) Process Description Δ 8) Interfaces
ORG.2.7	3) Process Description 2) Life Cycle Models 3) Process Description	3) Process Description Δ 8) Interfaces
ORG.2.8	3) Process Description 2) Life Cycle Models 3) Process Description 52) *Product / Service* Requirements 9) Standards 24) Quality statement or policy	3) Process Description Δ 28) Quality records 38) Process Measures
ORG.2.9	3) Process Description 2) Life Cycle Models 3) Process Description 52) *Product / Service* Requirements 9) Standards 24) Quality statement or policy	3) Process Description Δ 38) Process Measures
ORG.2.10	3) Process Description 6) Work Breakdown Structures 4) Job Procedure 27) Quality Criteria 39) Quality Measures 7) Work Products 30) Review strategy/plan 8) Interfaces	3) Process Description * Reference SUP.1
ORG.2.11	3) Process Description	14) Policies 9) Standards
ORG.2.12	3) Process Description	27) Quality Criteria 38) Process Measures
ORG.2.13	3) Process Description	17) Project Plan 87) Communication Mechanism 77) Distribution List 89) Training records

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ORG.3.1	52) Requirements 9) Standards 44) Product Needs Assessment 51) Contract 29) Assessment / Audit record 97) Corrective Actions Δ 21) Analysis Results 31) Review Records 83) Customer Request 46) Market Analysis 12) Business Goals 84) Problem Report 18) Process Performance Data 86) Customer Satisfaction Data 22) Risk Analysis 43) Benchmarking Data 38) Process Measures 39) Quality Measures 42) Service Level Measures	26) Improvement Opportunity
ORG.3.2	26) Improvement Opportunity	25) Quality strategy/plan Δ
ORG.3.3	3) Process Description	29) Assessment / Audit record
ORG.3.4	26) Improvement Opportunity 97) Corrective Actions Δ 12) *Process* Goals 3) Process Description 29) Assessment / Audit record 38) Process Measures	25) Quality strategy/plan Δ
ORG.3.5	26) Improvement Opportunity 97) Corrective Actions Δ 12) *Process* Goals 3) Process Description	25) Quality strategy/plan Δ
ORG.3.6	26) Improvement Opportunity 97) Corrective Actions Δ 12) *Process* Goals 3) Process Description	38) Process Measures 43) Benchmarking Data
ORG.3.7	26) Improvement Opportunity 97) Corrective Actions Δ 12) *Process* Goals 3) Process Description 25) Quality strategy/plan Δ	3) Process Description Δ * Reference: ORG.2

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ORG.3.8	26) Improvement Opportunity 97) Corrective Actions 3) Process Description 38) Process Measures 43) Benchmarking Data 18) Process Performance Data 86) Customer Satisfaction Data 25) Quality strategy/plan Δ 12) *Process* Goals 27) Quality Criteria	38) Process Measures Δ 43) Benchmarking Data
ORG.3.9	3) Process Description	17) Project Plan 87) Communication Mechanism 77) Distribution List 89) Training records
ORG.4.1	89) Training records 44) Product Needs Assessment 6) Work Breakdown Structures 23) Risk Management 17) Project Plan 16) Business Plan 4) Job Procedures, Practices 9) Standards 15) Personnel Policies	88) Training strategy/plan
ORG.4.2	88) Training strategy/plan	89) Training records 90) Training Material
ORG.4.3	88) Training strategy/plan 17) Project Plan Δ 44) Product Needs Assessment 6) Work Breakdown Structures	89) Training records
ORG.4.4	88) Training strategy/plan	89) Training records
ORG.5.1	1) Software Development Methodology 2) Life Cycle Models 12) Business Goals 7) any Work Product (i.e., designs, code, architecture, tests, etc.) 14) Policies 9) Standards 23) Risk Management 17) Project Plan 16) Business Plan	33) Reuse Strategy 84) Reuse Plan Δ
ORG.5.2	33) Reuse Strategy 84) Reuse Plan	84) Reuse Plan Δ 9) Standards

Practice to Work Product Mapping Table

Practice	Input work product type	Output work product type
ORG.5.3	84) Reuse Plan	34) Reusable Object *Reference. ENG.3, ENG.4, ENG.5, ENG.6, SUP.1
ORG.5.4	34) Reusable Object	35) Reuse Repository
ORG.5.5	9) Standards 34) Reusable Object	95) Change Control 31) Review Records Δ 35) Reuse Repository
ORG.5.6	17) Project Plan 84) Reuse Plan 35) Reuse Repository	1) Software Development Methodology Δ 2) Life Cycle Models Δ 3) Process Description Δ
ORG.5.7	94) Change Request 84) Problem Reports 95) Change Control 52) *Maintenance* Requirements	*Reference ENG.7
ORG.6.1	44) Product Needs Assessment	52) *Environment* Requirements 17) Project Plan Δ
ORG.6.2	17) Project Plan	104) Development Environment
ORG.6.3	104) Development Environment	* Reference CUS.6, CUS.7
ORG.6.4	94) Change Request 84) Problem Reports 95) Change Control 52) *Maintenance* Requirements	* Reference ENG.7
ORG.7.1	52) *Environment* Requirements 17) Project Plan	104) Development Environment Δ * Reference ORG.6
ORG.7.2	* Reference ORG.6 104) Development Environment 17) Project Plan 25) Quality strategy/plan	104) Development Environment Δ 103) Recovery plan
ORG.7.3	103) Recovery plan	102) Backup/recovery records
ORG.7.4	52) *Environment* Requirements 17) Project Plan	104) Development Environment Δ * Reference ORG.6
ORG.7.5	52) *Environment* Requirements 17) Project Plan	104) Development Environment Δ * Reference ORG.6

Annex D (normative)

Process indicators

Introduction

The work product characteristics listed in this Annex can be used when reviewing the potential inputs and outputs of an organization's process or practice implementation. The characteristics are provided as guidance for what attributes to look for in a particular sample work product to help assess if the process/practice which created the work product is adequate. Assessor judgement is needed to use this information to ensure that the application domain, business purpose, development methodology, size of the organization, etc. are taken into consideration as well as the characteristics of the work products. This table is not a checklist of what every organization must have, but rather it is a starting point for considering whether the work products are contributing to the intended purpose of the process.

The fields in the work product characteristics table contain the following information.

Work product identifier #	An identifier number for the work product which is used to reference the work product from the process management indicator table, and the process and practice mapping tables.
Work product type:	Provides a typical name associated with the work product characteristics. This name is provided as an identifier of the type of work product the practice or process might produce. Organizations may call these artefacts by different names. The name of the work product in the organization is not significant. Similarly, organizations may have several equivalent work products which contain the characteristics defined in one work product type. The formats for the work products can vary. It is up to the assessor and the organizational unit co-ordinator to map the actual work products produced in the organization to this idealized table.
Work product characteristics:	Provides the potential attributes associated with the work product types that the assessor should probe for in the samples provided by the organizational unit.

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
1)	Software Development Methodology	– Identification of the approach / method used to develop software – Identification of the life cycle model (waterfall, spiral, serial build, etc.) used to develop software – Provides a high level description of the process, activities, and controls
2)	Software Development Life Cycle Model	– High level description of activities performed at each life cycle phase – Sequencing of the life cycle phases – Identification of critical life cycle phase dependencies – Identification of required inputs, outputs to each life cycle phase – Identification of the key decision points (milestones) model – Identification of the quality control points in the model

3)	Process Description	– A detailed description of the process which includes:
		  – purpose of the process
		  – task and activities to be performed and ordering of tasks
		  – critical dependencies between task activities
		  – expected time required to execute task
		  – input/ outputs work products
		– Identifies process entry and exit criteria
		– Identifies internal and external interfaces to the process
		– Identifies process measures
		– Identifies quality expectations
		– Identifies functional roles and responsibilities

4)	Job Procedures, Practices	– Each tasks to be performed uniquely identified – Each task sequenced by execution order – Coverage of support information (i.e., commands and parameter settings, etc.) when required for operations – Establishes rules by which staff is expected to operate
5)	Schedule	– Identifies the tasks to be performed – Identifies the start and completion date for required tasks – Allows for the identification of critical tasks and task dependencies – Identifies task completion status, vs. planned date – Has a mapping to scheduled resource data
6)	Work Breakdown Structure	– Defines tasks to be performed – Documents ownership for tasks – Documents critical dependencies between tasks – Documents inputs and output work products – Documents the critical dependencies between defined work products

7)	Work Product	– Defines the attributes associated with an artefact from a process execution:
		  – key elements to be represented in the work product
		  – expected form, style
		  – expected media (paper, electronic) and storage attributes defined

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
8)	Interface	– Defines relationships between two products, process or process tasks – Defines criteria and format for what is common to both – Defines criteria critical timing dependencies or sequence ordering
9)	Standards	– Identification of who/what they apply to – Each requirement unique – Each requirement tagged with an identifier

10)	Coding Standards	*Coverage for software includes (but is not limited to) (as appropriate to the application):*
		– Data naming conventions
		– Defines required languages, compilers, data base management systems, etc.
		  – format of code, structure, comments required
		  – standard data structures, types, classes
		  – best practices
		– Required usage of tools: data dictionaries, associated CASE tools
		– Compatibility requirement for existing software and / or hardware
		– Security considerations
		– Performance considerations
		– Standard error messages, codes
		– Interface standards:
		  – human man-machine interfaces
		  – external system interfaces
		  – peripheral equipment, hardware
		– Storage and retrieval of source code and object modules
		– Quality and reliability standards

11)	Estimates	– Coverage (as appropriate to the application) for things like:
		  – size
		  – effort
		  – cost
		  – schedule
		  – resources
		– Estimates are realistic and achievable
		  – in line with resources allocated
		  – in line with historical records (where they exist)
		– Source data needed to make estimates was available and complete
		– Source data was validated

12)	Goals (Business, Quality, Organizational, Training, Performance)	– Identifies the objective to be achieved – Identifies who is expected to achieve the goal – Identifies any incremental supporting goals – Identifies any conditions/ constraints – Identifies the time frame for achievement – Are reasonable and achievable within the resources allocated – Are current, established for current project, organization – Used to monitor progress – Are optimized to support known performance criteria, plans

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
13)	Vision	– Provides information on the overall strategy for the organizational unit, organization, or business – Is authorized at the highest level – Defines the main objectives to be achieved
14)	Policies	– Authorized – Available to all personnel impacted by the policy – Establishes practices / rules to be adhered to
15)	Personnel policies	– Defines career opportunities for individuals in the organization – Defines team building strategy – Defines reward and recognition – Covers performance appraisal

16)	Plan
	(General attributes applies to all plans)
	(i.e., Business, Organization, Project, Quality, Review, Test)
		(as appropriate to the application and purpose):
		– Identification of the plan owner
		– Includes the objective of what is to be accomplished
		– Includes assumptions made
		– Includes constraints
		– Includes risks
		– Includes tasks to be accomplished
		– Method/approach to accomplish plan
		– Identifies task ownership
		– Includes schedules, milestones and target dates
		– Includes critical dependencies
		– Identifies quality criteria
		– Identifies required work products
		– Includes resources to accomplish plan objectives
		  – time
		  – staff
		  – materials/equipment
		  – budget
		– Includes contingency plan for non-completed tasks

17)	Project Plans + (16)[1]	– Defines
		  – work products to be developed
		  – life cycle model and methodology to be used
		  – customer requirements
		  – tasks to be accomplished
		  – task ownership
		  – project resources
		  – schedules, milestones and target dates
		  – quality criteria
		– Identifies:
		  – critical dependencies
		  – required work products
		  – project risks and risk mitigation plan
		– Contingency actions for non-completed tasks

1 The symbol + { n } is intended to imply that a generic work product description has been created to contain the majority of attributes common to many work products. These work products should also be used as an addition to the specific attributes mentioned for this particular work product.

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

18)	Process Performance Data	– Data comparing process performance against expected levels:
		  – defined input output work products available
		  – meeting minutes
		  – change records
		  – task completion criteria met
		  – quality criteria met
		  – resource allocation and tracking

19)	Meeting Minutes	– Documents meetings held
		– Defines:
		  – purpose of meeting
		  – attendees
		  – date, place held
		  – what was accomplished
		  – any open issues
		  – next action

20)	Progress Status record / report	– Record of the status of a plan(s) (actual against planned) such as:
		  – status of actual tasks against planned tasks
		  – status of actual results against established objectives/goals
		  – status of actual resource allocation against planned resources
		  – status actual cost against budget estimates
		  – status of actual time against planned schedule
		  – status of actual quality against planned quality
		– Record of any deviations from planned activities and reason why

21)	Analysis Results	– What was analyzed
		– Who did the analysis
		– The analysis criteria used:
		  – selection criteria or prioritization scheme used
		  – decision criteria
		  – quality criteria
		– Records the results
		  – what was decided / selected
		  – reason for the selection
		  – assumptions made
		– Potential risks

22)	Risk Analysis Record / Report	– Identifies the risks analyzed
		– Records the results of the analysis
		  – potential ways to mitigate the risk
		  – assumptions made
		  – constraints

23)	Risk Management Strategy / Plan + (59)	– Project risks identified and prioritized
		– Mechanism to track the risk
		– Threshold criteria to identify when corrective action required
		– Proposed ways to mitigate risks:
		  – work around
		  – corrective actions activities / tasks
		  – monitoring criteria
		  – mechanisms to measure risk

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
24)	Quality Statement / Policy	– Statement is official, approved – States commitment to quality principles – Identifies who is expected to follow policy

25)	Quality Strategy / Plan	– Objectives / goal for quality
		– Defines the activities tasks required to ensure quality
		– References related work products
		– Method of assessment / assuring quality
		– References any regulatory requirements, standards, customer requirements
		– Identifies the expected quality criteria
		– Specifies the monitoring time fame and quality checkpoints for the defined life cycle and associated activities planned
		– Target time-frame to achieve desired quality
		– Method to achieved goals
		  – tasks to be performed
		  – ownership for tasks
		  – resource commitments
		– Identifies the quality criteria for work products and process tasks
		– Specifies the threshold/tolerance level allowed prior to requiring corrective actions
		– Defines quality measurements and benchmark data
		– Defines the quality data collection mechanism and timing of the collection
		– Specifies mechanism to feed collected quality data back into process impacted by poor quality
		– Approved by the quality responsible organization/function

26)	Improvement Opportunity	– Identifies what the problem is – Identifies what the cause of a problem is – Suggest what could be done to fix the problem – Identifies the value (expected benefit) in performing the improvement – Identifies the penalty for not making the improvement
27)	Quality Criteria	*Defines expectations for quality:* – Establishes what is an adequate work product (required elements, completeness expected, accuracy, etc.) – Identifies what constitutes the completeness of the defined tasks – Establishes life cycle transition criteria and the entry and exit requirements for each process and / or activity defined – Establishes expected performance attributes – Establishes product reliability attributes
28)	Quality records	– Defines what information to keep – Defines what tasks/activities/process produce the information – Defines when the data was collected – Defines source of any associated data – Identifies the associated quality criteria – Identifies any associated measurements using the information – Identifies any requirements adherence to create the record, or satisfied by the record

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

29)	Assessment / Audit Records	– States the purpose of assessment
		– Method used for assessment
		– Requirements used for the assessment
		– Assumptions and limitations
		– Identifies the context and scope information required:
		  – date of assessment
		  – organizational unit assessed
		  – sponsor information
		  – assessment team
		  – attendees
		  – scope / coverage
		  – assessee information
		  – assessment Instrument (checklist, tool) used
		– Records the result
		  – identifies the required corrective actions
		  – improvement opportunities

30)	Review Strategy / Plan	– Defines:
		  – what to be reviewed
		  – roles and responsibilities of reviewers
		  – criteria for review (checklists, requirements, standards)
		  – expected preparation time
		  – schedule for reviews
		– Identification of:
		  – procedures for conducting review
		  – review inputs and outputs
		  – expertise expected at each review
		  – review records to keep
		  – review measurements to keep
		  – resources, tools allocated to the review

31)	Review Records	– Provides the context information about the review
		  – what was reviewed
		  – lists reviewers who attended
		  – status of the review
		– Provides information about the coverage of the review
		  – checklists
		  – review criteria
		  – requirements
		  – compliance to standards
		– Records information about the readiness for the review
		  – preparation time spent for the review
		  – time spent in the review
		  – reviewers , roles and expertise
		– Identifies the required corrective actions
		  – risk identification
		  – prioritized list of deviations and problems discovered
		  – the actions, tasks to be performed to fix the problem
		  – ownership for corrective action
		  – status and target closure dates for identified problems

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

32)	Reuse Plan	– Defines the policy about what items to be reused
		– Defines standards for construction of reusable objects
		  – defines the attributes of reusable components
		  – quality/reliability expectations
		  – standard naming conventions
		– Defines the reuse repository (library, CASE tool, file, data base, etc.)
		– Identifies reusable components
		  – directory of component
		  – description of components
		  – applicability of there use
		  – method to retrieve and use them
		  – restrictions for modifications and usage
		– Method for using reusable components
		– Establishes goal for reusable components

33)	Reuse Strategy	– Identify the goals for reuse are stated – Identify the commitment for creating reusable components – Determine which product lines and type of artefacts should be supported with reuse – Identify system and software components which can be reused within the organization – Identify the reuse repository and tools

34)	Reusable Object	– Developed to be:
		  – highly reliable
		  – generically defined (generic names, structures, etc.)
		  – interfaces (inputs and outputs) clear
		  – data encapsulated
		– Modification controlled
		– Modifications are downward compatible
		– Specification for usage defined
		– Specification for tailoring defined

35)	Reuse Repository	– Repository for reusable components (library, file, data base, tool)
		– Storage and retrieval capabilities
		– Ability to browse content
		– Listing of contents with description of reusable attributes
		– Ability to identify associated system information
		  – type of object maintained
		  – supported software / applications
		  – associated hardware configuration information
		  – required parameter information

36)	Measures
	(general applies to all specific measures)
		– Available to those with a need to know
		– Understood by those expected to use them
		– Provide value to the organization/project
		– Non-interruptive to the work flow
		– Appropriate to the process, life cycle model, organization
		– Are accurate
		  – source data is validated
		  – results are validated to ensure accuracy
		– Have appropriate analysis and commentary to allow meaningful interpretation by users

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

37)	Project Measures + (36)	*Coverage for key elements in the project plan such as:*
		– Monitors key processes and critical tasks provides status information to the project on:
		  – project performance against established plan
		  – resource utilization against established plan
		  – time schedule against established plan
		  – process quality against quality expectations and / or criteria
		  – product quality against quality expectations and / or criteria
		  – highlight software performance problems, trends
		– References any goals established

38)	Process Measures + (36)	– Measures about the process' performance:
		  – ability to produce sufficient work products
		  – adherence to the process
		  – time it takes to perform process
		  – defects related to the process
		– Measures the impact of process change
		– Measures the efficiency of the process

39)	Quality Measures + (36)	– Measures quality attributes of the work products defined
		  – product is adequate to do the job intended
		  – product is defect free
		  – product is usable
		  – product is complete
		  – product accurate
		  – product's is reliable
		– Measures the results of project activities
		  – tasks are performed on schedule
		  – product's development is within the resource commitments allocated
		– Measures quality attributes of the "end customer" product quality and reliability

40)	Risk Measures + (36)	– Identifies the probability of risk occurring – Establishes measures for each risk defined – Measure the change in the risk state

41)	Field Measures + (36)	– Measures attributes of the performance of system's operation at field locations, such as:
		  – field defects
		  – performance against defined service level measures
		  – system ability to meet defined customer requirements
		  – support time required
		  – user complaints (may be third party users)
		  – customers requests for help
		  – performance trends
		  – problem reports
		  – enhancements requested

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

42)	Service Level Measures + (36)	– Real time measures taking while a system is operational, it measures the system's performance or expected service level
		– Identifies things like:
		  – capacity
		  – throughput
		  – operational performance
		  – operational service
		  – service outage time
		  – up time
		  – job run time

43)	Benchmarking Data + (36)	– Identifies key process / product / market need information to be benchmarked – Measurement reflects comparison of the current performance against some well defined criteria or historical information (or benchmark)

44)	Product Needs Assessment	*Coverage for key elements (as appropriate to the application):*
		– Definition of the need:
		  – reason product is needed
		  – features and functions desired
		  – requirements to be satisfied
		– Constraints:
		  – cost limitations
		  – date / schedule requirements
		  – specific support software required
		  – interfaces requirements
		  – associated equipment or hardware required
		  – regulatory standards and/or requirements
		  – operational impacts
		– Business case:
		  – expected benefit
		  – expected cost (including projected installation, conversion and/or maintenance) vs. profit expectations
		  – market window, target delivery dates

45)	Acquisition Strategy / Plan	– Identifies what needs to be acquired – Establishes the approach for acquiring the product or service – Established the evaluation criteria – Identifies any constraints / risk

46)	Market Analysis Record / Report	– Contains information about:
		  – what was analyzed
		  – the selection criteria & prioritization scheme used
		  – the analysis criteria used
		– Records the results which identify the:
		  – market opportunities
		  – "market window"
		  – business drivers
		  – cost / benefit
		  – potential customers and their profiles information
		  – any assumptions made
		  – alternate solutions considered and / or rejected
		  – risks and/or constraints (regulatory issues)
		– Defines the product offering and target release

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

47)	Request for Proposal (RFP) (Requester)	– Reference to the requirements specifications
		– Identifies desired characteristics, such as:
		  – system architecture, configuration requirements or the requirements for service (consultants, maintenance, etc.)
		  – quality criteria or requirements
		  – project schedule requirements
		  – expected delivery / service dates
		  – cost / price expectations
		  – regulatory standards / requirements
		– Identifies submission constraints:
		  – date for resubmitted of the response
		  – requirements with regard to the format of response

48)	Supplier Proposal Response (Response to RFPs)	– Defines the suppliers proposed solution
		– Defines the suppliers proposed delivery schedule
		– Identifies the coverage identification of initial proposal
		  – identifies the requirements that would be satisfied
		  – identifies the requirements that could not be satisfied, and provides a justification of variants
		– Defines the estimated price of proposed development, product, or service

49)	*Subcontractor* or *Supplier* History records	– List of potential subcontractor/suppliers – Qualification information – Identification of their qualifications – Past history information when it exists

50)	Commitments / Agreements	– Signed off by all parties involved in the commitment / agreement
		– Establishes what the commitment is for
		– Establishes the resources required to full fill the commitment, such as:
		  – time
		  – people
		  – budget
		  – equipment
		  – facilities

51)	Contract (product or service)	– Signed
		– Defines what is to be purchased/delivered
		– Identifies time frame for delivery or contracted service dates
		– Identifies monetary considerations
		– Identifies any warranty information
		– Identifies any customer service requirements
		– References to any performance expectations constraints
		– References to any quality expectation / constraints
		– As appropriate to the contract the following are considered:
		  – references to any acceptance criteria
		  – references to any special customer needs (i.e., confidentiality requirements, security, hardware, etc.)
		  – references to any problem resolution procedures
		  – identifies any interfaces to independent agents and subcontractors

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
52)	Requirement Specification (Internal or External) (Product, Service, Customer, System, Software, Documentation)	– Each requirement is identified – Each requirement is unique – Each requirement is verifiable or can be assessed – Consideration is given to the following (as appropriate to the product or service and type of requirement) *Products / Application Requirements* – identify any required feature and functional characteristics – identify any necessary performance considerations/constraints – identify any necessary external interface considerations/constraints – identify any necessary internal interfaces considerations/constraints – identify any required system characteristics/constraints
52)	(cont'd)	– identify any security considerations/constraints – identify any environmental considerations/constraints – identify any operational considerations/constraints – identify any associated documentation considerations/constraints – identify any installation considerations/constraints – identify any support considerations/constraints – identify any design constraints – identify any reliability or quality expectations *Service Requirements* – identify any performance expectations – identify any time schedule / constraints – identify any tasks to be performed – identify any responsibilities – identify the method of communication, project reporting expected – identify any quality expectations / controls *Document Requirements* – purpose / objectives defined – proposed contents (coverage) defined – intended Audience defined – identification of supported software release, system information – identification of associated software requirements and designs satisfied by document – identification of style, format, media standards expected – definition of the intended distribution requirement

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

53)	System Design / Architecture	– Provides an overview of all system design
		– Describes the interrelationship between system components
		– Describes the relationship between the system components and the software
		– Specifies the design for each required system component consideration is given to things like:
		  – memory/capacity requirements
		  – hardware interfaces requirements
		  – user interfaces requirements
		  – external system interface requirements
		  – performance requirements
		  – commands structures
		  – security / data protection characteristics
		  – system parameter settings
		– Reusable components
		– Mapping of requirements to system components

54)	High Level Software Design	– Describes the overall software structure
		– Identifies the required software components
		– Identifies the relationship between software components
		– Consideration is given to:
		  – any required software performance characteristics
		  – any required software interfaces
		  – any required security characteristics required
		  – any database design requirements
		  – any required error handling & recovery attributes

55)	Low Level Software Design	– Provides detailed design (could be represented as a prototype, flow chart, entity relationship diagram, pseudo code, etc.) – Provides format of input/output data – Provides specification of data storage needs – Establishes required data naming conventions – Defines the format of required data structures – Defines the data fields and purpose of each required data element – Provides the specifications of the program structure

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
56)	Software Units (Code)	– Follows established coding standards (as appropriate to the language and application): – commented – structured or optimized – meaningful naming conventions – parameter information identified – error codes defined – error messages descriptive and meaningful – formatting - indented, levels – Follows data definition standards (as appropriate to the language and application): – variables defined – data types defined – classes and inheritance structures defined – objects defined – Entity relationships defined – Data base layouts are defined – File structures and blocking are defined – Data structures are efficient – Algorithms defined are efficient – Functional interfaces defined – Best practices for language used defined
57)	Build Lists	– Identification of aggregates of the software application system – Identification of required system components (parameter settings, macro libraries, data bases, job control languages, etc.) – Necessary sequence ordering identified for compiling the software release – Input and output source libraries identified
58)	Traceability Record / Mapping	– Identifies requirements to be traced – Identifies a mapping of requirement to life cycle work products – Provides the linkage of requirements to work product decomposition (i.e., requirement->design->code->test->Deliverables, etc.) – Provides forward and backwards mapping of requirements to associated work products throughout all phases of the life cycle Note: this may be included as a function of another defined work product (example: A CASE tool for design decomposition may have a mapping ability as part of it's features)

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
59)	Test Strategy / Plan (all test plans)	– Identification of test purpose – Identification of the responsible test plan owner – Identifies the approach to performing the test – Identification of components to be tested – Identify aggregates and sequence for testing – Identification of required system configuration (software, hardware, interface components) – Identification of the associated development owner for components to be tested – Identification of associated test scripts/test cases – Sequence ordering of how testing will be executed – Identification of *requirements* which will be validated by tests (i.e., customer requirement, regulatory requirements and system requirements – Identification of the problem reporting mechanism – Identification of the test tools and resources required (test channels, analyzers, test emulators, etc.) – Identification of the test schedule – Identification of the test completion criteria – Official source libraries and versions of software defined
60)	Test Script	– Defines what is being tested – Defines the required system configuration for the test – Identifies all required software components – Identifies special initializations, parameter setting, etc. – Identifies the input date required – Sequences the ordering of the test cases – Defines the expected test results – Identifies what requirements were met by performing the test
61)	Test Case	– Provides executable set of test instructions – Purpose defined – Mapped to test scripts, requirements

62)	Test Results	– Records results of testing
		  – Identifies what components were tested
		  – Identifies date test was executed
		  – Status at completion of test (actual test results compared to predicted results in test plan(s))
		  – Record of test configuration at time of test
		  – Record of trouble reports generated from testing

63)	Unit Test Strategy / Plan + (59)	– Identifies strategy for verifying unit functionality (i.e., a program, a block, a module, a routine) against the requirements and design – Specifies how basic program requirements will be verified
64)	Software Test Plan + (59)	– Identifies strategy for verifying software features and/or functions operate as defined in the requirements

65)	Integration Test Strategy / Plan + (59)	– Purpose of integration defined:
		  – validation of a subset of the system (all programs required to make a sub-system work, a feature work, etc.)
		  – validation of the integration of software to other system components (hardware, support equipment, interfaced system)

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

66)	System Test Plan + (59)	– Identifies strategy for verifying the integration of system components as defined in the system architecture specification
		– Provides test coverage for all components of the system:
		  – software
		  – hardware
		  – external interfaces
		  – customer documentation
		  – installation activities
		  – initialization
		  – conversion programs

67)	Regression Test Strategy / Plan + (59)	– Plan for validating that existing systems / features-functions have not been impacted by a change – Plan for validating that change has not impacted working components of the system (interfaces, operations, etc.) – Plan for validating that change is compatible with existing system requirements (downward compatible) – Identification of the requirements for system component *not* changed – Identification of what system components are to be regression tested (i.e., features, functions, interfaces, fixes) – Identification of the changes made – Identification of the regression test cases to be executed – Conditions for execution of regression testing
68)	Acceptance Test Strategy / Plan + (59)	– Identified activities to be performed to test "deliverable" end customer product – Identifies who has responsibility for performance of acceptance test activities (supplier or customer) – Identifies the system configuration requirements for site – Identifies the installation requirements for site – Provides a plan for validating the "delivered" software – Identifies how to validate installation activities at customers site were performed correctly – Identifies how to validate the deliverables satisfied the customer requirements – Identifies associated test scripts/test cases – Identifies actions to be take upon acceptance of product
69)	Release Strategy / Plan + (16)	– Identifies the functionality to be included in each release – Identifies the associated components required (i.e., hardware, software, documentation etc.) – Mapping of the customer requests, requirements satisfied to particular releases of the product

70)	Release Package	– Includes the software
		– Includes and associated release elements such as:
		  – system software components
		  – required hardware
		  – associated customer documentation
		  – parameter definitions defined
		  – command language defined
		  – installation instructions
		  – release letter

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

71)	Release (Notes) Information	*Coverage for key elements (as appropriate to the application):*
		– Description of what is new or changed (including features removed)
		– System information and requirements
		– Identification of conversion programs and instructions
		– Identification of the component list (version identification included)
		  – software modules, libraries, etc.
		  – associated documentation list
		  – associated hardware requirements
		– New / changed parameter information and/or commands
		– Backup and recovery information
		– List of open know problems, faults, warning information, etc.
		– Identification of verification and diagnostic procedures
		– Technical support information

72)	Integrated Software	– All components specified on a software build list for the aggregate is included
		– Fully configured aggregate of the software components:
		  – parameters defined
		  – commands defined
		  – data loaded or converted

73)	System	– All components of the product release are included
		– Any required hardware
		– Integrated software
		– Customer documentation
		– Fully configured set of the "system components":
		  – parameters defined
		  – commands defined
		  – data loaded or converted

74)	Installation Strategy Plan + (16)	– Identifies product deployment objectives
		– Identifies schedules for deployment activities
		– Identifies schedule constraints
		– Identifies impacted site locations
		– Identifies site environment configuration
		– Identification of the required components for the installation with appropriate version information (consideration given to at least the following):
		  – released software
		  – required maintenance fixes
		  – support software required (conversion programs, validation routines, associated system interfaces, data base management system)
		  – required customer documentation
		  – installation instructions
		  – identification of required hardware and peripheral equipment
		– Identification of supporting information or materials required:
		  – parameter information
		  – operation and maintenance information
		  – pre-conversion information, materials or installed equipment

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
74)	(cont'd)	– Type of installation (new vs. conversion of existing system, maintenance) – Identification of backup and recovery procedures – Identification of customer contacts and technical support personnel – Identification of *go / no-go* decision criteria– Identification of verification process: – of required tasks to prepare deliverables required – of components required at site – of installation procedures – of pre- installation construction or conversion activities – of system integration, release builds, etc. – Identification of customer acceptance requirements
75)	Installation Guide	*Coverage for key elements (as appropriate to the application):* – Tasks for loading/installing product sequentially order by execution requirements – downloading of software from delivery files – up-loading to appropriate software to files, folders, libraries, etc. – partial or upgrade installation instructions, where applicable – initialization procedures – conversion procedures – customization / configuration procedures – verification procedures – bring-up procedures – operations instructions
75)	(cont'd)	– Installation requirements identified: – associated hardware, software, customer documentation – conversion programs and instructions – initialization programs, system generation information – components and descriptions – minimum configuration of hardware/software required – backup / recovery instructions – validation programs – configuration parameters (e.g. size requirements, memory, etc.) – Customer / technical support contacts
76)	Packaging Record	– Content information of what is shipped or delivered electronically – Special handling instructions
77)	Distribution List	– List of current list of receivers and their delivery address – Identification of media expected for delivery (manual, CD-ROM email, etc.)
78)	Delivery Instructions	*Coverage for key elements (as appropriate to the application):* – Sequential ordering of tasks to be performed – Applicable releases identified – Identification of all delivered components with version information – Identification of any necessary backup and recovery procedures

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
79)	Delivery Record	– Record of items shipped/delivered electronically to customer – Identification of who it was sent to – Identification of address where delivered – Identification of the date delivered

80)	Handling and Storage Guide	– Defines the tasks to perform in handling and storing products
		– Provides a description of how to store the product including:
		  – storage environment required
		  – the protection media to use
		  – packing materials required
		  – what items need to be stored
		– Provides retrieval instructions

81)	Acceptance Record	– Record of the receipt of the delivery – Identification of the date received – Identification of the delivered components – Records the verification of any customer acceptance criteria defined – Signed by receiving customer

82)	Customer Support Procedures	*Coverage for key elements (as appropriate to the product or contract):*
		– Tasks to follow in providing support defined
		– Defines the availability and coverage the support provided:
		  – hot-line #
		  – hours of availability
		  – appropriate expertise
		  – cost
		– Defines a schema for classification of customer request and /or problems:
		  – definition of request type
		  – definition of priority/severity
		  – definition of response time expectations, by type and severity
		– Standards for what information to retain from a customer, such as:
		  – company and location
		  – contact information details
		  – description of the request
		  – reference to supporting information sent (dumps, files)
		  – customer system site configuration information (product, release, version, last update)
		  – impacted system(s)

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
82)	(cont'd)	– impact to operations of existing systems – criticality of the request – expected customer response/closure requirements – Definition of customer escalation procedures – Identification of *customer support tools* available and procedures for using them, such as: – mechanism used to record customer requests – status reports – systems available to reproduce problems – ability to reproduce customers software environment – ability to reproduce problems – rest emulators – rest scripts – dial-in ports – dump analysis tools
83)	Customer Request record (internal or external)	– Identifies request purpose, such as: – new development – enhancement – internal customer – operations – documentation – informational – Identifies request status information, such as: – date opened – current status – date assigned and responsible owner – date verified – date closed – Identifies priority/severity of the request – Identifies customer information, such as: – company/person initiating the request – contact information and details – system site configuration information – impacted system(s) – impact to operations of existing systems – criticality of the request – expected customer response/closure requirements – Identifies needed requirements/standards – Identifies information sent with request (i.e., RFPs, dumps, etc.)

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
84)	Problem Report record	– Identifies the name of submitted and associated contact details – Identifies system configuration information (such as: release versions, system software, hardware configuration, etc.) – Identifies the group/person(s) responsible for providing a fix – Includes a description of the problem – Identifies any associated support information (dumps, files, etc.) – Identifies the severity of the problem (critical, major, minor..) – Identifies the status of the reported problem – Identifies the components of the product affected – Identifies the applicable software product release and version information – Identifies the date "opened" – Identifies the target release(s) problem will be fixed in – Identifies the expected closure date – Identifies any associated problem reports, customer requests, duplicate problems, associated fixes – Identifies any closure criteria
85)	Customer Satisfaction Survey	– Identification of customer and customer information – Date requested – Target date for responses – Identification of associated software and hardware configuration – Ability to record feedback

86)	Customer Satisfaction Data	– Determines levels of customer satisfaction with software products and services
		– Mechanism to collect data on customer satisfaction:
		  – results of field performance data
		  – results of customer satisfaction survey
		  – interview notes
		  – meeting minutes from customer meetings

87)	Communications Mechanism	*A way to distribute information:* – Clear description of what is being communicated – Ability to specify date information sent – Ability to distribute to all impacted – Identification of the impact: (software, development, customer, organization, etc.) – Provides a clear identification as to who/what the message applies – Mechanism for recipient to respond when required (return information) – The distribution media used is accessible to all with a need to know – The distribution list is current and includes all with a need to know – Ability to specify target return date information
88)	Training strategy/plan + (16)	– Defines current staff capabilities – Defines the skills required – Outlines course available to achieve training goal

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

89)	Training records	Record of employee's training
		– Identifies employee's name
		– Identifies any courses taken (date, hours, course title)
		– Identifies current skills/capabilities/experience level, lists:
		  – formal education
		  – in-house training
		  – mentoring
		– Identifies future training needs
		– Identifies current status of training requests

90)	Training Material	– Synchronized to current supported versions of the software – Updated and available for new releases – Coverage of system, application, operations, maintenance as appropriate to the application – Courses listings and availability
91)	Configuration Management (CM) plan	– Defines or references the procedures to control changes to configuration items – Defines measurements used to determine the status of the CM activities – Defines CM audit criteria – Approved by the CM function – Identifies configuration library tools or mechanism – Specifies the location and access mechanisms for the CM library. – Archival and retrieval mechanism specified
92)	Configuration Management (File, Library, System)	– Version control – Check in/out capability – Can recreate any release or test configuration – Maintain configuration item descriptions – Ability to report configuration status – Changes to configuration items are tracked to change/user requests

93)	Configuration Item	– Item which is maintained under configuration control (software, documents, work products)
		– Version identification is maintained
		– Description of the item is available including things like:
		  – type of item
		  – associated configuration management library, file, system
		  – responsible owner
		  – date when place under configuration control
		  – status information (i.e., development, baselined, released)
		  – relationship to lower level configured items
		  – identification of the change control records
		  – identification of change history

94)	Change Request	– Identifies purpose of change – Identifies request status (new, accepted, rejected) – Identifies requester contact information – Impacted system(s) – Impact to operations of existing system(s) defined – Impact to associated documentation defined – Criticality of the request, date needed by

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

95)	Change Control Record	– Used as a mechanism to control change to baselined products/ products in official project release libraries
		– Record of the change requested and made to a baselined product (work products, software, customer documentation, etc.)
		  – identification of system, documents impacted with change
		  – identification of change requester
		  – identification of party responsible for the change
		  – identification of status of the change
		– Linkage to associated customer requests, internal change requests, etc.
		– Appropriate approvals
		– Duplicate requests are identified and grouped

96)	Change History	– Historical records of all changes made to an object (document, file, software module, etc.)
		  – description of change
		  – version information about changed object
		  – date of change
		  – change requester information
		  – change control record information

97)	Corrective Actions (logs, plans, minutes)	– Identifies the initial problem – Identifies the ownership for completion of defined action – Defines a solution (series of actions to fix problem) – Identifies the open date and target closure date – Contains a status indicator

98)	Tracking system	– Ability to record customer and process owner information
		– Ability to record related system configuration information
		– Ability to record information about problem or action needed
		  – date opened and target closure date
		  – severity/criticality of item
		  – status of any problem or actions needed
		  – information about the problem or action owner
		  – priority of problem resolution
		– Ability to record proposed resolution or action plan
		– Ability to provide management status information
		– Information is available to all with a need to know
		– Integrated change control system(s)/records

99)	Work-around (temporary solutions)	– Problem identification
		– Release and system information
		– Temporary solution, target date for actual fix identified
		– Description of the solution
		  – limitations, restriction on usage
		  – additional operational requirements
		  – special procedures
		  – applicable releases
		– Backup/recovery information
		– Verification procedures
		– Special installation instructions

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
100)	Product Configuration	– Overview of the system's configuration – Defines each component and their position in the architecture of the system – Defines the key system interfaces – Defines any network considerations – Defines the hardware configuration – Defines any system performance/parameter settings

101)	Database Designs	*Coverage for key elements (as appropriate to the application):*
		– Definition of design characteristics:
		  – database management system used
		  – type of system (relational, hierarchical, object oriented, networked)
		  – format of records, tables, objects
		  – database access mode
		  – associated software (programs, user screen formats, reports)
		  – supported database language
		– Definition of logical and physical views, models:
		  – records (data layouts, fields, tables, structures)
		  – field names and definitions
		  – data definitions, classes, structure, etc.
		  – entity / relationships
		  – classes, inheritance scheme
		– Definition of user views
		  – screen layouts
		  – field access
		  – data access
		  – commands
		  – Input / output interface considerations
		– Database usage information (contents, application systems, usage restrictions, etc.)
		– Identification of constraints:
		  – security considerations
		  – data access considerations
		  – back-up and recovery considerations
		  – system restart considerations
		  – system generations considerations
		  – performance considerations

102)	Back-up / Recovery Records	– Date of back-up – Listing of what was backed-up with associated versions – Listing of where it was backed-up to – Identification of associated system attributes and configuration at time of back-up – Identification of associated recovery procedures

Work product characteristics table

WP Id.#	Work product type	Work product characteristics

103)	Recovery plan	– Identifies what is to be recovered
		– Procedures / methods to perform the recover
		– Schedule for recovery
		  – time required for the recovery
		  – critical dependencies
		– Resources required for the recovery
		  – list of backups maintained
		  – staff responsible for recovery and roles assigned
		  – special materials required
		  – required work products
		  – required equipment
		  – required documentation
		– Locations and storage of backups
		– Contact information on who to notify about the recovery
		– Verification procedures
		– Cost estimation for recovery

104)	Development Environment	– Floor plan – Environmental safety considerations – Regulatory requirements – Contractual requirements – Security considerations – Facility configuration – Special environmental requirements (e.g. air conditioning, raised floor, power, etc.) – Individual workspace needs defined – Workstations requirements – Supporting software – Tools – Communication equipment – Disaster recovery plan
105)	*Customer Documentation* Test Plan	– Meets customer requirements – Approved by customer – Identifies deliverable documentation – Define or reference templates – Document verification addressed

Work product characteristics table

WP Id.#	Work product type	Work product characteristics
106)	Customer Documentation	– Coverage for key elements (as appropriate to the application)*:* *External system documents* – system overview, architecture, design guide – feature guide (functional descriptions of system components) – diagnostic guide: error messages and codes – operating commands reference guide – installation, operations and maintenance guide – technical support guide *Internal customer documents* – requirements – designs – test plans – plans – records – Documentation kept synchronized with latest associated software release: – available with delivery of a new or changed version of the software – updated with maintenance releases (as appropriate to change request resolution) – Ordering procedures – Current site distribution and maintenance list maintained
107)	Installation records	– Record of what was installed – Release and system configuration information recorded – Special site specific information recorded – Identification of any acceptance testing performed – Installation performance information captured – ability to bring up system after installation conversion – number of faults found after the installation or conversion – time to install – Customer approval signatures
108)	System Component	– Hardware components – Software components – Customer documentation – Training materials
109)	Personnel Records	– Relevant information about personnel including: – Name, address, date of birth, marital status – Grade, pay, appraisal history – Disciplinary history

Annex E (informative)

Assessment instrument concepts

E.1 Assessment instrument indicators

E.1.1 Introduction

The practices in the process model in part 2 of this International Standard are the criteria against which an assessment is performed. These practices represent "good practice", but in order to make them applicable to all software applications and domains, they are defined as abstract, high level concepts without constraining the ways in which they may be implemented. Consequently, practices are subject to wide interpretation which can have an adverse effect on the repeatability and reliability of assessment results.

Assessment indicators represent a set of attributes that might be found in an instantiation of a process and hence can be used to judge adequacy. Indicators are not requirements: they provide a set of detailed discriminators used to assess whether a particular instantiation of a practice meets the intent of the practice in the process model in part 2.

The performance of a process typically produces tangible work products (inputs and outputs associated with the execution of the practices). The indicator set represents a common starting point for assessing these process artefacts and the practices that produced them. Use of the standard set of indicators increases the consistency of assessor judgement and enhances the repeatability of the results.

The output of the assessment, in the form of a process profile, shows the adequacy ratings of the generic practices of the process, but it does not show why a particular practice was assigned a particular rating. Indicators help to identify what is present or missing from a process or work product and provide guidance to the assessor when assigning a rating of adequacy to a practice. The information provides an "indication" of the extent to which a practice supports the purpose of the process. The detailed information captured during the assessment about the presence or absence of specific indicators provides the valuable input into analysis and process improvement planning.

An assessor’s judgement of practice adequacy is always made within the context of the process of the assessment scope and purpose. Organizational business goals, and the size, complexity and criticality of the software, are factors that influence an assessor's judgement. As these factors are unique to every assessment, the standard set of indicators do not include everything an assessor must consider in reaching a judgement. Indicators can be characterized best as "guidance, memory joggers, triggers, discriminators, hints, examples".

In addition, since many organizations employ different techniques to create software, the absence of some indicators in some situations may not be significant. Care should be taken when using the assessment indicators to understand that the set provides a consistent set of probes to help recognize the characteristics of adequacy in a consistent way, not an all inclusive checklist of required elements.

The process model in part 2 of this International Standard provides the flexibility to define extended processes. Consequently, the indicator set may be tailored by adding indicators to support the practices of the extended processes. The standard set of assessment indicators may also be tailored to suit a particular assessment objective, application domain, or risk. Tailoring should be performed in a manner that retains the common basis for result comparison.

Two types of assessment indicators, process indicators and process management indicators, are defined to address the base and generic of practices defined in the process model in part 2.

E.1.2 Process indicators (PI)

E.1.2.1 Overview

Process Indicators (PI) provide guidance to the assessor on how to judge a base practice to determine its existence or adequacy rating. There are two main components associated with process indicators: base practices and work products. To avoid duplication, base practices are not listed in the standard set of indicators in this document other than by reference to the practice number in the process model in part 2. It is anticipated that when an assessment instrument is created, the practices will be extracted directly from the process model in part 2 of this International Standard and used in conjunction with the work products types and their associated characteristics.

The performance of tasks similar to those defined in the base practices provides the first indication that an implemented process includes the defined good practice. This provides some evidence of the existence of base practices. To support the judgement of practice adequacy, associated work product types and characteristics are defined. The characteristics of the work products assist the assessor in understanding what elements to expect in a meaningful instantiation of a work products type.

Figure 1 shows the relationship of process indicators to the organization's process. Work product characteristics are mapped to a sample of the organization's input and output work products. The organization's process activities are reviewed to ensure performance of the base practices.

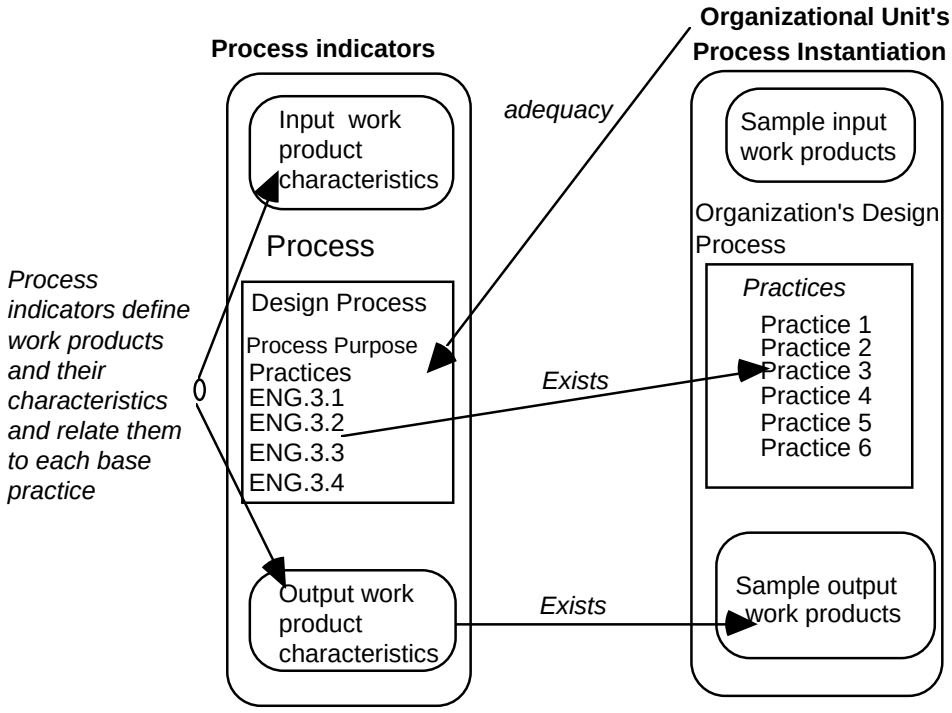

Figure 1 - Process indicators usage

E.1.2.2 Work products

Work products are the result of the execution of the practices within an organization. The existence of sample work product types provides further evidence that the defined practice is actually performed in the organizational unit. However, practice existence alone does not provide evidence of a sufficient implementation. To assist the assessor in this evaluation, a standard set of work product types and their associated characteristics is defined. Work products characteristics are used in the judgement of adequacy. This judgement is usually performed simultaneously by using process indicators and process management indicators (see below). Understanding the connectivity between these two sets of indicators is important in the assessment of generic practices for the process under review. Examining work products can also provide evidence for the rating of generic practices. For example, a document may have a version number implying that is under configuration management (see generic practice 2.2.2).

As work product names can vary from organization to organization, the exact names associated with specific work product types are not significant. However, an assessor would expect to find an equivalent representation of the work product that would provide the coverage of the attributes defined in the work product characteristic set. For example, in assessing the process Develop Software Design (ENG.3), an assessor may find four work products: Functional Framework; Signal Specification; Flow Diagram; and Interface Specification. Using the work product characteristics, the assessor may find that these four products collectively contain the characteristics expected of the work product type High Level Software Design.

The existence of work product characteristics tends to indicate a adequate instantiation of the output of a performed practice. This does not imply that not finding all the defined characteristics makes for an inadequate implementation. If some characteristics are missing, the assessor makes a judgement as to the significance in this particular application. If the missing characteristics are significant, the information should be recorded by the assessor.

There may be circumstances when the defined characteristics are not-applicable. For example, when an organization is employing a new type of process technology that is unique to their process. This should be recorded in the assessment record for subsequent analysis and process improvement purposes.

E.1.3 Process management indicators

Process management indicators are associated with each generic practice in capability levels 2-5. Similar to process indicators, they complement the assessor's ability to recognize the performance of generic practices. They provide assistance in rating generic practice adequacy, and help to identify the ability of the organization to manage a process effectively.

In addition, process management indicators provide a structured way of recording in the assessment record what was found in a particular instantiation of a process. During an assessment, process management indicators are used in conjunction with the process indicators to give the assessor a view of process capability.

Process management indicators are used to probe the attributes of a process that affect the way that the organization manages the process. They assist the assessor in judging the adequacy of the implemented generic practices. Figure 2 shows the relationship between the process management indicators and process indicators to the process model defined in part 2 of this International Standard.

The assessment examines the process of the organization against this process model. The architecture of the process model uses the concept of generic practices which may be applied to any process, and groups the generic practices into capability levels such that the attainment of each level adds significantly to the capability to perform that process.

The process management indicators and process indicators provide a framework for assessment, and help to ensure that:

- assessors have the ability to interpret the organization's instantiation of a process consistently against the process model in part 2;
- the data are captured for subsequent analysis to support the sponsor's needs;
- the information needed for the organizational unit to plan and perform process improvement is captured;
- assessment results are representative, reliable and repeatable.

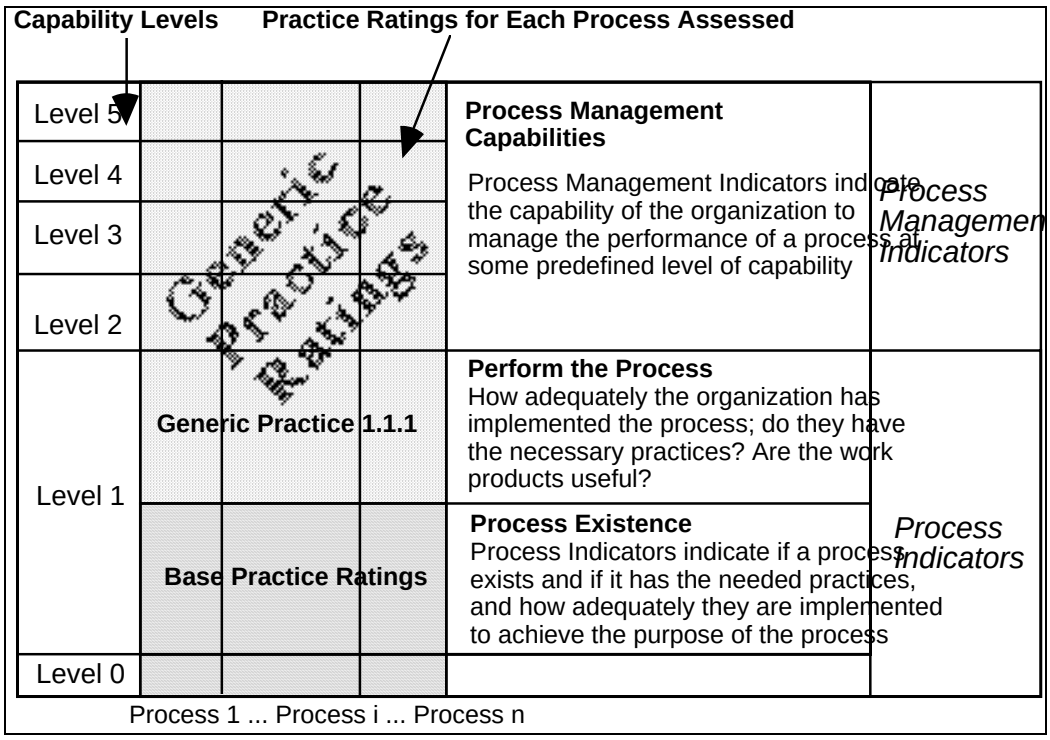

Figure 2 Relationship of process management indicators and process indicators to the process model.

E.2 Assessment instrument data handling

An assessment instrument, even paper-based, should provide a repository for information about the adequacy of practices, the existence of assessment indicators, and other types of information (organizational observations, notes about particular judgements, profiles, etc.). Data collection and retrieval mechanisms affect the usability of the assessment instrument.

Although information about the assessment indicators should be recorded, it does not form part of the process profile, and is typically not given back to the sponsor of a capability determination. Although, some sponsors may desire supporting information for analysis in process capability determination, the use of the data captured within an assessment instrument should be the subject of a pre-assessment agreement between all parties involved (the assessor, the sponsor, the organizational unit). The agreement should cover storage, maintenance and use of the detailed records.

The characteristics defined by the indicators provide a detailed record of what was found in the organizational unit. The data captured are significant both for assessor's evaluation and for subsequent analysis and planning for process improvement.

Assessments can generate a large quantity of data. The support provided by automated assessment instruments and tools to handle the data significantly affect the efficiency and effectiveness of the assessment. It is important, therefore, that the assessment instrument is able to provide the right level of support for gathering, processing and storing assessment data.

E.3 The relationship of assessment instruments to ratings

Assessment ratings are assigned for the base practices and generic practices of assessed processes according to the requirements for rating in part 3 of this International Standard. The output is represented as process profiles, containing generic practice ratings and derived capability level ratings, and an assessment record, containing the base practice ratings and supporting information. Actual practice adequacy ratings are determined for each assessed process instance. Generic practice adequacy ratings may be aggregated to form a view of the performance of a process at each of the capability levels. The diagram in figure 3 shows how the information contained in the assessment instrument, indicators and practices, come together to support a rating.

There are many approaches that can be used to gather data. The method and approach will depend on many factors including:

- the size of the organization being assessed;
- the number of organizational units involved in the assessment;
- -– the level of organizational participation in performing the assessment (collecting the data, demonstrating conformance);
- the maturity of the supplier-sponsor relationship (the level of trust between the organization and sponsor);
- the needs of the sponsor;
- the expertise and ability of the assessor(s);
- the needs of the organization.

The assessment instrument design should be of a scope to cover the intended approach. Guidance on the factors which affect the usability of various types of assessment instrument is included in the informative annexes of this part of the International Standard.

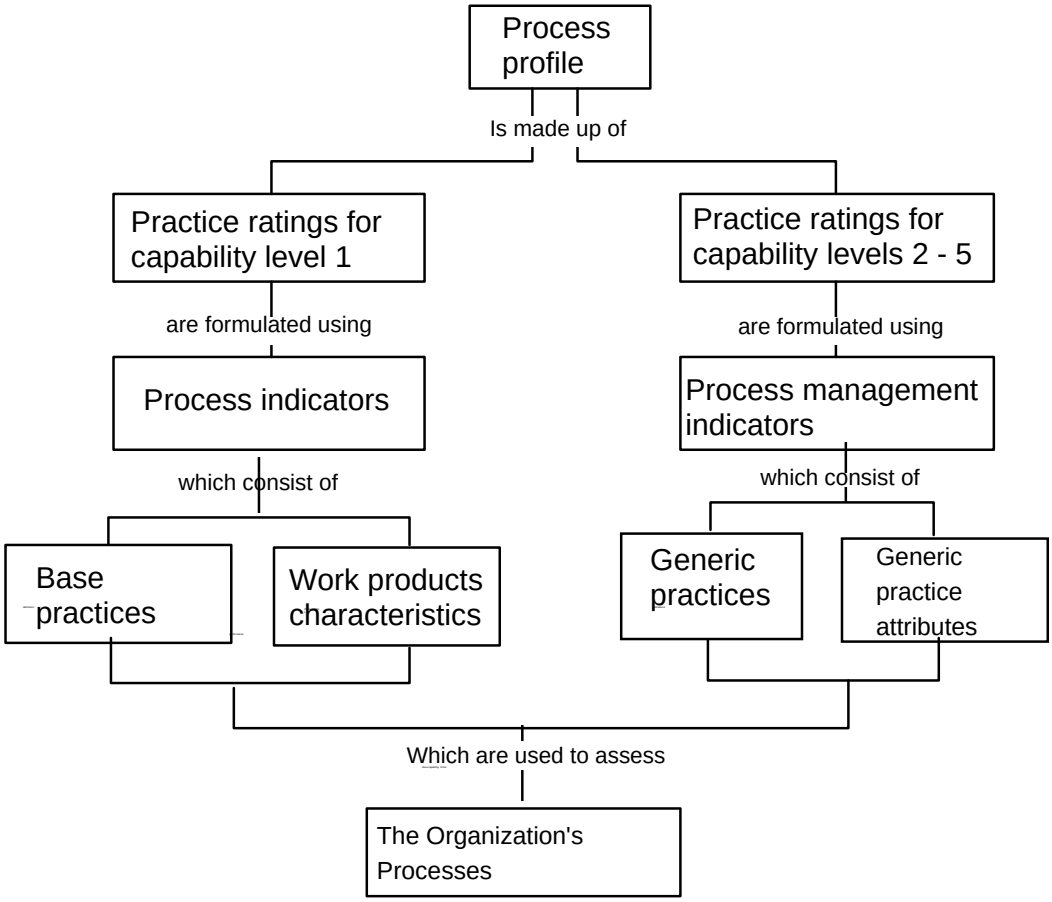

Figure 3 – Putting the elements together to determine a rating

Annex F (informative)

Construction, selection and use of an assessment instrument

F.1 Introduction

This section gives guidance on the purchase or construction of an assessment instrument to support the objectives specified in this standard. It specifies the types of assessment instruments and the associated features and functions that impact the design options related to an instrument's effectiveness and usability. This section:

- describes the two basic types of assessment instrument;
- sets out the modes of use and usability for both types of assessment instrument;
- highlights key considerations in the creation or tailoring of an assessment instrument;
- identifies some of the issues to consider in selecting an assessment instrument.

The classification scheme for quality characteristics of software in ISO/IEC 9126:1991 forms a useful overall framework for consideration in the specification, construction, selection and use of an assessment instrument. In addition, Annex G describes and classifies a number of desirable features of assessment instruments which should be considered by users selecting instruments suitable to their own specific needs and assessment contexts and by instrument developers creating assessment instruments targeted at specific methodologies or approaches.

F.2 Basic types of assessment instrument

There are two basic types of assessment instrument, paper-based manual instruments and automated computer-based instruments, which have different characteristics. An understanding of the benefits and limitations of each type helps to ensure that a chosen assessment instrument supports the assessment purpose and scope. The appropriateness of an assessment instrument depends on the planned mode of use and assessment methodology. To ensure optimum performance (effectiveness and efficiency), assessment instruments should be selected or designed to match the assessment approach.

F.2.1 Paper-based assessment instruments

Using a paper-based instrument in an assessment demands careful foresight and planning. A paper-based tool may be adequate for an assessment of limited scope where only a few processes are to be assessed, but may become unwieldy for an assessment of broader scope. Assessing all the base and generic practices for each process, and generally for more than one instance of each process, generates a significant amount of data to record, track and manage.

There are a variety of formats for paper-based assessment instruments which can be used effectively, depending on the approach, style of assessor or methodology. A paper-based assessment instrument may be implemented, for example, as a questionnaire, a checklist, or an assessment recording form. The usability of a paper-based assessment instrument is an important design consideration. Its usability has a strong relationship to the effectiveness of the instrument in a particular assessment mode.

In an assessment, a paper-based assessment instrument is most effectively used:

– for collection of a limited amount of data, such as in a focused assessment of a few process areas;

– in a distributed approach, such as when forms are distributed throughout an organization for self-assessment;

– when the sampled work-products and process data are collected incrementally and reviewed prior to the commencement of on-site assessment activities, such as interviews;

– when sampling an organization to obtain a pre-assessment of the potential level of capability;

– when developing a prototype or trialing a new assessment methodology.

The benefits of using a paper-based instrument include low initial development cost, portability and relative ease of construction.

The limitations associated with paper-based assessment instruments include:

– the inability to support automated scoring and the aggregation of results across multiple instantiations or organizational units;

– the inability to change content dynamically to suit the scope of the assessment or to tailor for organizational characteristics discovered during the assessment;

– the limited ability to select indicators dynamically to suit the individual assessment interview needs;

– the limited ability to store and retrieve assessment results for subsequent use in process improvement or capability determination;

– the inability to generate result profiles or help in the performance of gap analysis;

– the large amounts of paper to be managed; especially when used in large organizations with multiple process instantiations.;

– the extensive configuration management control of the instruments created and the results collected;

– the potential insecurity of the data collected;

– the difficulty of use in organizations whose processes differ from those for which the assessment instrument was designed;

– the dependency on the assessor and the assessment method. Additional assessor training may be required on the concepts associated with the process model defined in part 2 of this International Standard.

F.2.2 Computer-based assessment instruments

A computer based assessment instrument may be implemented as a spreadsheet, a data base application system, an expert system or integrated into a CASE tool application. Computer based assessment instruments may be integrated into the software development life cycle, allowing for more real time improvement opportunities. Well-designed tools can enhance the trust and credibility of self-assessment. With the right tools, process owners can perform a self-assessment and get trusted results. A computer-based assessment instrument has several advantages over a paper-based design, including:

- the ability to be implemented and used in a distributed manner, to collect data incrementally at set milestone check points in the performance of a process or when a number of organizational units are to be assessed incrementally;
- the effectiveness of storing and retrieving assessment results, making the results more usable for process improvement planning or capability determination analysis;
- the ability to assist the assessor with post-assessment analysis of the results such as the analysis of process improvement results against past performance history, or of a supplier profile against an established target profile;
- the ability to build assessment expertise directly into the tool, allowing a less qualified assessor to perform the actual assessment. This can release scarce resources and transfer them to actual process improvement activities rather than assessment activities;
- the ability to perform dynamic scoping and tailoring, allowing for customization to support specific cultural, organizational, sponsor, or assessment team needs;
- the ability to assist the assessor with the processing of the assessment data collected;
- the ability to aggregate and generate results in a variety of formats to suit individual sponsor needs. For example: reports, charts, profiles, lists of practice conformance attributes, etc.;
- the ability to secure the data captured in the assessment to ensure confidentially;
- the ability to process data from multiple process instantiations or across multiple organizational units simultaneously to encourage self-assessment.

Any computer-based assessment instrument design should maximize its usability and support for the given assessment mode. Failure to consider options for maximizing efficiency in collecting and processing the data could render it ineffective. The major limitations associated with an automated assessment tool involve its high initial start-up cost and the time associated with building and maintaining a computer system. Automated assessment instruments are also subject to the limitations of computer software. A poor design or implementation can do the opposite of what is intended.

A table in Annex G lists characteristics associated with assessment instruments and their use. This table provides assistance to sponsors and assessment teams for the selection of appropriate features to support their particular needs. A designer or a purchaser may use these tables as a guide to the benefits and limitations associated with a particular assessment instrument, or mode of use. The quality characteristics defined in Annex G are applicable to the design of a any tool and should be considered.

F.3 Modes of use and usability of types of assessment instrument

An assessment instrument may be used in several modes:

– by an assessor or assessment team to conduct an assessment. The results may be captured by a paper-based instrument, or a lap-top computer;

– by process owners and/or organizational unit representatives during preparation for and prior to an assessment. The results can be captured by the instrument for subsequent processing, or to demonstrate conformance for external validation by a third party assessor, thereby reducing the time and cost associated with an assessment;

NOTE : This is the most efficient way to collect data prior to conducting interviews given the large number of practices contained in the process model defined in part 2 of this International Standard.

– by organizational unit representatives continuously throughout the software development life cycle, and at defined milestones to measure process adherence, process improvement progress or to gather data to facilitate a future assessment.

NOTE : This type of distributed approach is most effective when using automated tools integrated into the life cycle such as performance monitoring tools, project management tools or CASE tools.

– after the assessment to retrieve or organize the assessment data to facilitate process improvement planning or analysis for capability determination.

NOTE : The detailed data captured during the assessment are valuable inputs to an organization and enhances the organization's understanding of the ratings of practices and process.

F.4 Creating an assessment instrument

This section gives guidance on the creation of an assessment instrument using the assessment indicators contained in Annexes A to D, the practices contained in the process model defined in part 2 of this International Standard, and the requirements in clause 4 of this document.

The instrument designer should understand the intended use and assessment methodology that the tool will be expected to support. The instrument may be targeted at experienced assessors for use in a standalone mode, or distributed throughout an organization to enable less experienced assessors (such as the process area representatives) to use the tool in self-assessment mode. An assessment tool enables much of the data to be gathered prior to the assessor's visit, expediting the assessment process and increasing the organizational representatives' ownership of the assessment results. The more sophisticated the assessment tool the less assessor expertise is required.

In creating an assessment instrument, the designer should:

– understand the methodology and approach to be used for the assessment;

– select the tool characteristics based upon the planned implementation, methodology, or sponsor need. Annex G outlines the design options available;

– choose an appropriate type of instrument based on the methodology and intended use of the instrument;

– review the indicator set presented in Annexes A to D in relation to the scope and context of the assessment or the objectives of the instrument supplier. Indicators are selected based upon the scope, or other performance considerations;

– select the process, practices and associated indicators relevant to the scope of coverage (see clause 4). An automated instrument can enable the selection to be performed dynamically (i.e. as the instrument is being used);

– tailor or format the indicators in the selected set. An automated assessment instrument can enable tailoring or scoping of the indicators to be performed dynamically (i.e. during the assessment);

– consider the requirements of the sponsor(s) with respect to the usage mode, business needs for results presentation, interfaces to other products, storage of results, confidentiality, etc.

F.5 Tailoring to suit a particular assessment need

Specific requirements for what may be tailored and what is required when tailoring an assessment instrument are given in clause 4 of this document. The designer or qualified assessor participating in the tailoring of the assessment instrument should also address the following guidelines:

– the assessment instrument should be under configuration management during its creation and maintenance;

– the assessor should ensure that after customization, the requirements in clause 4 continue to be met;

– the requirements of the sponsor(s) should be considered when tailoring an assessment instrument, or example, the method of use, the input medium and the output presentation format.

F.6 Selecting an assessment instrument

Prior to selecting an assessment instrument, the purchaser should review the requirements and recommendations in clause 4 of this document and the requirements for assessment in part 3 of this International Standard. The following issues should be considered:

- the intended mode of use, method of assessment, and the scope of the elements contained in the process model defined in part 2 of this International Standard;
- the purpose of the assessment – process improvement (part 7 of this International Standard), or the determination of supplier process capability (part 8 of this International Standard);
- the direct impacting of any customization on the tool's performance;
- the quality aspects described in Annex F;
- which of the features or functions covered in Annex F are required;
- supplier identified limitations, or usage requirements;
- support for the instrument (training, hot-line, documentation, etc.);
- the use of a supplier's past history or current assessment results as valuable input to a procurement decision;
- the evaluation of the conformance of the tool to the requirements of this International Standard;
- the desirability of placing the tool under configuration management control.

Annex G (informative)

Quality and design attributes

G.1 Introduction

This annex contains a list of desirable features to be considered in building or purchasing an assessment instrument.

Where software-based tools are developed or used to support assessments, ISO/IEC 12119 - 1995 may provide a useful mechanism for demonstrating or verifying their conformance to the requirements in this part of the International Standard.

F.2 lists quality features classified by quality characteristics as defined in ISO/IEC 9126:1991 (Functionality, Reliability, Usability, Efficiency, Maintenability and Portability). Since some features enhances more than one quality characteristic, the feature has been described under the quality characteristic to which it contributes most.

F.3 lists design considerations,benefits and drawbacks of different types of assessment instruments (manual, on-line and expert systems).

F.4 lists desirable instrument attributes associated with different assessment purposes, types, approaches and scopes.

These tables are intended as guidance and can be helpful to designers or purchasers of assessment instruments.

G.2 Quality attributes of assessment instruments

G.2.1 Functionality

Functionality encompasses a set of attributes that bear on the existance of a set of functions and their specified properties. The functions are those that satisfy stated or implied needs.

Features related to the functionality characteristic are described in other parts of this document. Additionally, the following paragraph addresses the security aspects of assessment instruments.

G.2.1.1 Security

The security of the data captured by assessment instruments needs to be considered. A computer-based instrument may need security mechanisms in order to support specific confidentiality requirements imposed by the sponsor or assessed organization. The following security capabilities should be considered:

- preventing unauthorized access by others;
- incorporating an access password on automated tool implementations;
- putting appropriate restrictions and proprietary markings on documents used to collect, and report findings;
- locking files and limiting access to the data collected (automated or manual);
- the method to be used to maintain the confidentiality of any support data captured.

G.2.2 Reliability

Reliability encompasses a set of attributes that bear on the capability of an automated assessment instrument to maintain its level of performance under stated conditions for a stated period of time.

Features that may impact the reliability of an automated instrument are described below.

G.2.2.1 Repeatable results

Any automated features of the tool should be checked to ensure that it gives repeatable results when performing aggregations or data manipulations.

G.2.2.2 Tool reliability

The tool should reliably store data indefinitely without corruption or loss. The tool should not exhibit failures which corrupt data under the expected operational conditions.

G.2.3 Usability

Usability encompasses a set of attributes that bear on the effort needed for use, and on the individual assessment of such use by a stated or implied set of users.

The following features contribute to the usability of an assessment instrument.

G.2.3.1 Instruction and usage support

Desirable features are on-line help, context-sensitive help, and complete and clear user documentation.

G.2.3.2 User-friendly interface

The assessment instrument should be easy to use. In automated tools, friendly interfaces such as windowing, pull-down menus, pop-up tables etc., are desirable.

With all tools, information gathered is useful for assigning adequacy to different practices. Having a consolidated view of all information related to a practice or process may be helpful to the assessor. In cases such as this, the instrument may provide automatic spreading of the information to the related point of use.

Automated tools may also provide automatic prompting for missing information, and provide a way to check coverage of the organization.

Paper based tools should be organized by the intended usage in a particular assessment to support, for example: practices needed for specific interviews; ease of finding the data; ease of distributing the forms to appropriate assessors or organizational unit representatives; and ease of collating results.

G.2.3.3 Availability of training and support

Automated assessment instruments should be accompanied by appropriate training materials and supporting services provided by the creator/supplier.

Paper-based assessment instrument creators should supply appropriate directions on using the paper instruments, collating information from various instances and generating results, using the information contained on the paper forms.

Assessment tool training should be readily available. Training may take many forms, including on-line tutorials, instructor lead courses, self-study. In developing training for an assessment instrument consideration should be given to:

- the type of assessment instrument, its key features, and its use;
- assessment approach(es) supported by the assessment instrument;
- how the instrument meets the requirements specified in clause 4;
- tailoring or customization of the indicators in the tool;
- processing the data captured during an assessment to establish a rating profile / score;
- how to access and use the assessment results.

Users of a computer based assessment instrument my need additional training in:

- installation including the required environment;
- features of the assessment instrument;
- entering, modifying and storing data;
- automated results generation, reporting, etc.

G.2.3.4 Industry/application domain specific

Instruments can be built for specific usage in specific assessment contexts. Flexibility to add and delete information from an assessment instrument may be a desired feature.

G.2.3.5 Usability of user documentation

User documentation should be provided for automated tools. Associated documentation should be easy to understand and provide information on its operation, use, features, and limitations. A paper-based tool should provide forms, definitions and usage instructions. All documentation should be correct and consistent with the operation of the instrument.

G.2.4 Efficiency

Efficiency encompasses a set of attributes that bear on the relationship between the level of performance of the instrument and the amount of resources used under stated conditions.

G.2.4.1 Efficiency of use

The design of the tool and the intended method of assessment can affect its performance and use. Considerations should be given to the following:

- the implementation medium used;
- processing and transaction entry speed;
- distribution capabilities (e.g. paper-based mailing lists, automated networking capabilities);
- data storage, archiving and retrieval;
- sorting abilities;
- data results segregation and presentation abilities;
- data presentation and input design (paper: form design; automated: screen layout and human factors such as ease of data entry, elements per screen, function keys, etc.).

G.2.4.2 Methodology impacts

The assessment methodology employed affects the type and efficiency of the assessment instrument design. Considerations should be given to:

- the approach to data collection;
- the support for distributive and incremental collection of data;
- the assessment type (team based, tool-based self-assessment, assisted self-assessment, etc.).

G.2.5 Maintainability

Maintainability encompasses a set of attributes that bear on the effort needed to make specified modifications (for instance tailoring).

G.2.5.1 Ease of tailoring

Tailoring of the assessment instrument may be required in order to support the creation of extended process, limiting the scope, etc. This should be easy to accomplish possibly directly by the user.

G.2.5.2 Supporting the latest version of the standard

Assessment instruments need to keep pace with the evolution of the standard, so they should be built to allow easy upgrading of the practices and indicator data within the assessment instrument.

G.2.6 Portability

Portability encompasses a set of attributes that bear on the ability of a assessment instrument to be transferred from one environment to another. Again the intended usage and the defined methodology will impact the design when portability of the tool is required. Factors to consider in deciding whether a portable implementation is required are:

- meeting the needs of the users;
- requirements for distributed collection and joint analysis;
- the ability to use the tool(s) in remote locations;
- volume of data collected;
- the need to download data collected for analysis.

G.3 Attributes of types of assessment instruments

G.3.1 Manual instruments (questionnaires, checklists)

Design considerations	– distributed input capabilities – ability to split by process, job function – ability to maintain records – how ratings will be aggregated together from different forms – how to segregate process ratings from extended process ratings – how it will be used
Benefits	– low initial development cost – no training on operational attributes – portable-location independent
Drawbacks	– difficult to scope for organizational characteristics once created – pre-assessment preparation required – assessors may need more training on the concepts associated with the standard process and practices – more difficult to add, change or delete extended practices once created – more difficult to analyze results of multiple organizational units – manual aggregation of results of multiple organizational units – manual calculation of score – difficult to store and use past results for follow-up – security of data – may result in a large amount of paper for large organizations.

G.3.2 On-line instruments (Databases, CASE tools)

Design considerations	– ability to add extended processes as required – during assessment, ability to scope the assessment to the context information – ability to automatically calculate a score – ability to automatically produce the presentation of the results – assessment result storage and retrieval – distributed processing desirable – portability considerations (usability for team interviews, distributed inputs, simultaneous inputs) – ability to handle multiple assessors' inputs – ability to download large amounts of data – performance considerations (access speed, update speed) – usability for team interviews, self-assessment
Benefits	– medium development cost – easy assessment result storage and retrieval – ease of scoping during the assessment – ability to calculate score – ability to generate results, reports, etc.
Drawbacks	– additional training required on how to use an instrument – assessor training or expertise needed on the standard – performance considerations (access speed, update speed) – cost of maintenance and improvement as standard changes – portability is by design – distributed usage is by design

G.3.3 Expert systems

Design considerations	– level of assessor expertise to build into the instrument – ability to add extended processes as required – ability to scope the assessment to the context information – portability (usability for team interviews, distributed inputs, simultaneous inputs) – ability to automatically calculate the score – ability to automatically generate reports, profiles, presentation of results – storage and retrieval capabilities – ability to integrate with other tools (metrics, case, etc.)
Benefits	– less training required for the person performing the assessment – expertise of assessor is built into the instrument – ability to automatically calculate the of score – ability to automatically generate reports, profiles, presentation of results – storage and retrieval capabilities
Drawbacks	– higher development cost – additional training required on how to use instrument – portability is by design only – distributed usage is by design – performance considerations (access speed, update speed) – maintenance and improvement of tools as knowledge base grows

G.4 Instrument attributes associated with usage and methodology

G.4.1 Assessment purpose

Assessment Purpose	Desirable Instrument Attributes
Process improvement	– capture whether practice is or is not implemented – determine how adequate the implemented process is – capture process information related to what needs to be improved – ability to capture information by organizational unit – record scope of the assessment as defined in the assessment input – capture history to demonstrate improvement
Capability determination	– capture whether practice is or is not implemented – determine how adequate the implemented process is – aggregation of scores for all organizational units assessed – record scope of the assessment as defined in the assessment input

G.4.2 Assessment types

Assessment type	Desirable Instrument Attributes
Full assessment	– contains all base practices, and all indicators
Focused assessment	– contains base practices and indicators on process (or job function) being assessed
Basic assessment	– could be a standard vendor developed tool – support for standard practices
Extended process assessment	– capability to support added processes, practices and indicators – ability to delete added processes – ability to calculate and display adequacy results of processes and existence of base practices separately from extended processes.
Initial assessment	– ability to record / store assessment results – ability to record context information – ability to handle a full assessment of all process to baseline the organization
Follow-up assessment	– ability to record assessment results, perhaps incrementally – ability to access historical information – ability to use stored historical data – ability to use past results – ability to perform sampling of processes – ability to display profile changes from previous to current assessment

G.4.3 Assessment approach

Assessment approach	Desirable instrument attributes:
Tool based	– ease of data entry and retrieval – expertise of assessor built into the tool: process model architectural concepts may be needed because the user may have less experience with assessment concepts – documentation on how to use tool, install the tool etc. – human factors: table of contents, help screens, tutorials – contains basic indicators and base practices for process being assessed – results may need to be stored for subsequent validation by third party or for process improvement planning – ability to be distributed throughout an organization – ability to input data from multiple sources simultaneously – ability to be distributed by job function of the organizational unit representative, or process owner – ability to maintain an audit trail of who input data – security to restrict assess to organization unit or process owner – output capability: results generation capabilities (profile generation) – output capability: report generation capabilities segregated by organizational unit/process owner – ability to scope the context by attributes representative inputting the data (i.e., process area, job function, etc.)
Team based	– needs to contain indicators and base practices for process being assessed – ability to scope to context attributes of the organization or interview (processes assessed, job function of the interviewee, etc.) – ability to be used in a distributed fashion by multiple team members – ability to assimilate results from multiple sources – portability of the tool to go to remote sites – real-time performance: speed of data input and retrieval is critical – ability to call up practices required for specific interviews – ability to load data prior to the interview (documentation review information, organization model, types of interviews, etc.) – output capability: formal presentation of the results may be required – output capability: interim feedback to participants may be required – output capability: results generation capabilities (profile generation) – output capability: report generation – security considerations if used on-site – restrict access to the results to organizational unit and appropriate representatives

G.4.4 Assessment scope

Assessment scope	Desirable Instrument Attributes
Single organizational unit or one process instantiation	– one profile or score is required – usually one process instantiation to assess – ability to store past scores – ability to record ratings from more than one person
Multiple organizational units or multiple process instantiation	– ability to have the ability to aggregate scores from various instances of the same process – ability to store past scores – ability to merge the results of different instances recorded by different tools for the same assessment. – ability to record ratings from more than one person – ability to record ratings from more than one process instance – ability to record results more than once, multiple profiles may be required – ability to aggregate scores from multiple instances

Annex H (informative)

References

1. ISO/IEC 9126:1991: Software Quality Characteristics:

2. ISO/IEC 12207-1: Information Technology - Part 1: Software life-cycle process

The following documents contain definitions and may provide general guidance to terms in the indicator set.

3. ISO/AFNOR: Dictionary of Computer Science

4. ISO 8402: Quality Management and Quality Assurance; vocabulary

5. ISO 2382/1: Data Processing - Vocabulary

6. ISO/IEC 2382-20: Information Technology - Vocabulary