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Information technology — Process assessment —

Part 6: An exemplar system life cycle process assessment model

Technologies de l'information — Évaluation des procédés —

Partie 6: Un exemple de modèle d'évaluation des procédés du cycle de vie d'un système

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15504-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This first edition of ISO/IEC 15504-6 cancels and replaces ISO/IEC TR 15504-6:2008.

— Clause 2 is modified by updating the reference to ISO/IEC 15288;

— Clauses 4 and 5 are replaced with new text provided below;

— Clause 6.6 is replaced with new text provided below;

— Annex B.2 is replaced with new text provided below;

— The Bibliography is updated to reflect current versions of works referenced.

ISO/IEC 15504 consists of the following parts, under the general title *Information technology — Process assessment*:

— Part 1: Concepts and vocabulary

— Part 2: Performing an assessment

— Part 3: Guidance on performing an assessment

— Part 4: Guidance on use for process improvement and process capability determination

— Part 5: An exemplar software life cycle process assessment model

— Part 6: An exemplar system life cycle process assessment model

— Part 7: Assessment of organizational maturity

— Part 8: An exemplar process assessment model for IT service management

— Part 9: Target process profiles

— Part 10: Safety extension

Introduction

This part of ISO/IEC 15504 provides an example of a System Life Cycle Process Assessment Model for use in performing a conformant assessment in accordance with the requirements of ISO/IEC 15504-2.

An integral part of conducting an assessment is to use a process assessment model that is constructed for that purpose, is related to a process reference model and is conformant with ISO/IEC 15504-2, which sets out the minimum requirements for performing an assessment in order to ensure consistency and repeatability of the ratings.

A process reference model cannot be used alone as the basis for conducting consistent and reliable assessments of process capability because it requires greater detail to indicate process performance and capability. Therefore:

— the descriptions of process purpose and process outcomes provided by a process reference model need to be supported with a comprehensive set of indicators of process performance; and

— the capability levels and process attributes defined in ISO/IEC 15504-2 and its associated rating scale need to be supported with a set of indicators of process capability.

This additional detail describes a process reference model in terms of a process assessment model that can enable the assessment of consistent and repeatable ratings of process capability.

This Process Assessment Model contains a set of indicators to be considered when interpreting the intent of its Process Reference Model. These indicators may also be used when implementing a process improvement program or to help evaluate and select an assessment model, method, methodology or tools.

The Process Reference Model defined in ISO/IEC 15288:2008 has been used as the basis for the Process Assessment Model in this part of ISO/IEC 15504.

As an exemplar, this Process Assessment Model embodies the core characteristics that could be expected of any Process Assessment Model consistent with ISO/IEC 15504-2. Nevertheless, use of this Process Assessment Model is not required to meet the requirements of ISO/IEC 15504; any other process assessment models meeting the requirements of ISO/IEC 15504-2 may be used in a conformant assessment.

This part of ISO/IEC 15504 has a similar structure to Part 5. It may be used in conjunction with Part 5 for joint assessment of system life cycle processes and software life cycle processes.

This part of ISO/IEC 15504 uses the classification structure of the information work products used in ISO 15289 *Systems and software engineering — Content of systems and software life cycle process information products (Documentation)* as a basis for the Generic Work Products.

Within this part of ISO/IEC 15504:

— Clause 4 provides a detailed description of the structure and key components of a process assessment model, which includes two dimensions: a process dimension and a capability dimension. Assessment indicators are introduced in this clause;

— Clause 5 addresses the process dimension. It uses process definitions from ISO/IEC 15288 to designate the Process Reference Model. The processes of the Process Reference Model are described in the Process Assessment Model in terms of purpose and outcomes and are grouped in four process categories. The Process Assessment Model expands the Process Reference Model process definitions by including a set of process performance indicators called base practices for each process. The Process Assessment Model also defines a second set of indicators of process performance by associating work

products with each process. Clause 5 is also linked directly to Annex B, which defines the work product characteristics;

— Clause 6 addresses the capability dimension. It duplicates the definitions of the capability levels and process attributes from ISO/IEC 15504-2, and expands each of the nine attributes through the inclusion of a set of generic practices. These generic practices belong to a set of indicators of process capability, in association with generic resource indicators, and generic work product indicators. Annex B is also linked directly to Clause 6 as it defines the work product characteristics;

— Annex A provides a statement of conformance of the Process Assessment Model to the requirements defined in ISO/IEC 15504-2;

— Annex B provides selected characteristics for typical work products to assist the assessor in evaluating the capability level of processes;

— Annex C contains style guides for defining base practices, work products and generic practices for adjusting the Process Assessment Model, and guidance explaining how to expand or adapt the model; and

— The bibliography contains a list of informative references.

Information technology — Process assessment —

Part 6:
An exemplar system life cycle process assessment model

1 Scope

This part of ISO/IEC 15504 constitutes a Process Assessment Model, conformant with the requirements of ISO/IEC 15504-2, for the assessment of process capability of system life cycle processes.

The Process Dimension of this Process Assessment Model is based upon the Process Reference Model contained in ISO/IEC 15288.

This part of ISO/IEC 15504 provides a new Process Dimension for the Process Assessment Model derived from the revised Process Reference Model contained in ISO/IEC 15288:2008.

The scope of this part of ISO/IEC 15504 is consistent with the scope of ISO/IEC 15504-5 in order to assist situations where assessment is being made of both system and software life cycle processes.

NOTE Users of this part of ISO/IEC 15504 can freely reproduce the detailed descriptions contained in the exemplar assessment model as part of any tool or other material to support the performance of process assessments, so that it can be used for its intended purpose.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15288:2008, *Systems and software engineering — System life cycle processes*

ISO/IEC 15504-1:2004, *Information technology — Process assessment — Part 1: Concepts and Vocabulary*

ISO/IEC 15504-2:2003, *Information technology — Process assessment — Part 2: Performing an Assessment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 15504-1 apply.

4 Overview of the exemplar Process Assessment Model

4.1 Introduction to Overview

This part of ISO/IEC 15504 provides an exemplar Process Assessment Model that includes examples of assessment indicators.

The Process Reference Model defined in ISO/IEC 15288, associated with the process attributes defined in ISO/IEC 15504-2, establish a Process Assessment Model used as a common basis for performing assessments of systems engineering process capability, allowing for the reporting of results using a common rating scale.

The Process Assessment Model is a two-dimensional model of process capability. In one dimension, the process dimension, the processes are defined and classified into process categories. In the other dimension, the capability dimension, a set of process attributes grouped into capability levels is defined. The process attributes provide the measurable characteristics of process capability.

Figure 1 shows the relationship between the general structure of the Process Assessment Model, ISO/IEC 15504-2 and ISO/IEC 15288.

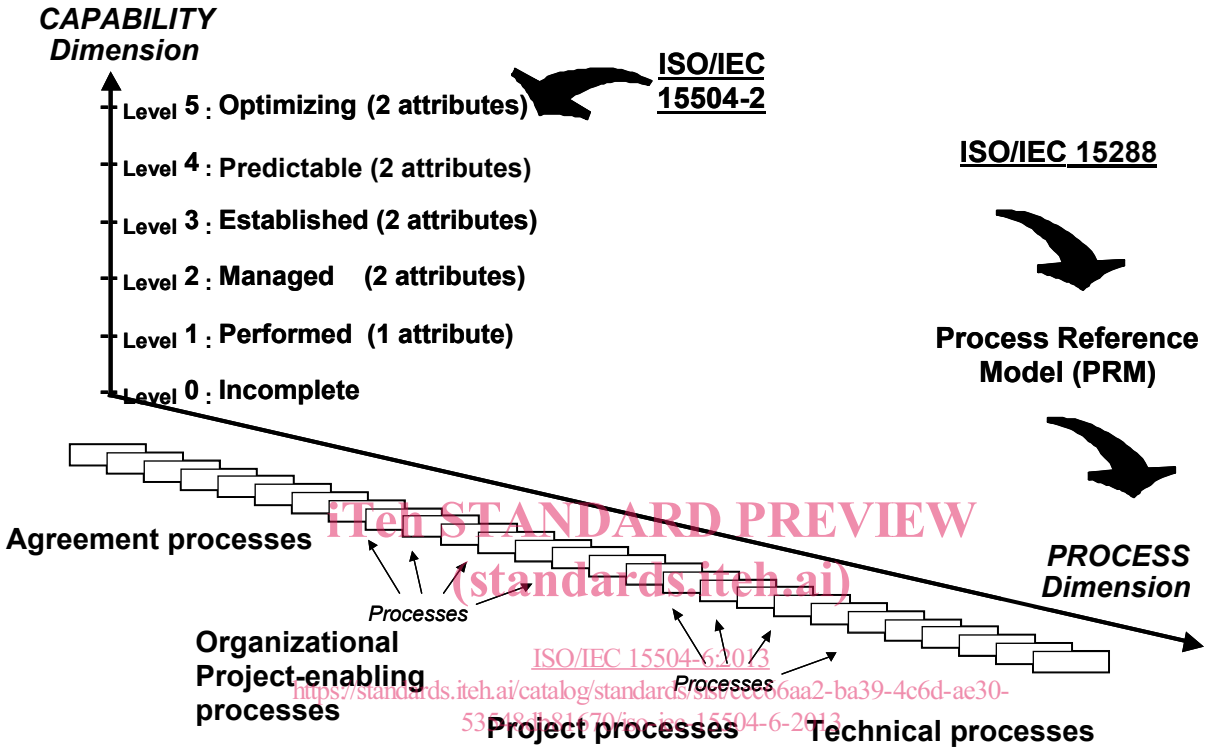

Figure 1 — Relationship between the Process Assessment Model and its inputs

A process reference model and a capability dimension defined in ISO/IEC 15504-2 cannot be used alone as the basis for conducting reliable and consistent assessments of process capability since the level of detail provided is not sufficient. The descriptions of process purpose and outcomes in a process reference model, and the process attribute definitions in ISO/IEC 15504-2, need to be supported with a comprehensive set of indicators of process performance and process capability that are used for assessment performance.

The exemplar Process Assessment Model defined in this part of ISO/IEC 15504 is conformant with the ISO/IEC 15504-2 requirements for a Process Assessment Model, and can be used as the basis for conducting an assessment of systems engineering process capability.

In order to meet the process assessment model requirements of ISO/IEC 15504-2, a documented process supporting other requirements of ISO/IEC 15504-2 is also required. This need may be met, for example, by the adoption of a supporting method for conducting assessments.

4.2 Structure of the exemplar Process Assessment Model

This clause describes the detailed structure of the Process Assessment Model and its key components.

This Process Assessment Model expands upon the Process Reference Model by including a defined set of assessment indicators. Assessment indicators comprise indicators of process performance and process

capability and are defined to support an assessor's judgment of the performance and capability of an implemented process.

Clause 5, together with its associated Annex B, describes the components of the process dimension, and Clause 6 describes the components of the capability dimension. Annex A provides a statement of conformance of the Process Assessment Model to the requirements defined in ISO/IEC 15504-2.

ISO/IEC 15504-2 requires that processes included in a process reference model satisfy the following:

"The fundamental elements of a Process Reference Model are the set of descriptions of the processes within the scope of the model. These process descriptions shall meet the following requirements:

a) A process shall be described in terms of its Purpose and Outcomes.

b) In any description the set of process outcomes shall be necessary and sufficient to achieve the purpose of the process.

c) Process descriptions shall be such that no aspects of the measurement framework as described in clause 5 of this International Standard beyond level 1 are contained or implied."

As processes are derived directly from ISO/IEC 15288, these requirements are satisfied.

The Process Assessment Model includes processes, which are grouped in four process groups identical to the process groups in ISO/IEC 15288. The four process groups are:

- the Agreement system life cycle processes group;
- the Organizational project-enabling processes system life cycle processes group;
- the Project system life cycle processes group;
- the Technical system life cycle processes group.

In addition, the Tailoring Process is included since this is defined in a normative Annex of ISO/IEC 15288. The Tailoring Process is presented before the four process groups in order to align subsequent clause numbering of processes in this document with equivalent processes in ISO/IEC 15288.

4.2.1 Processes

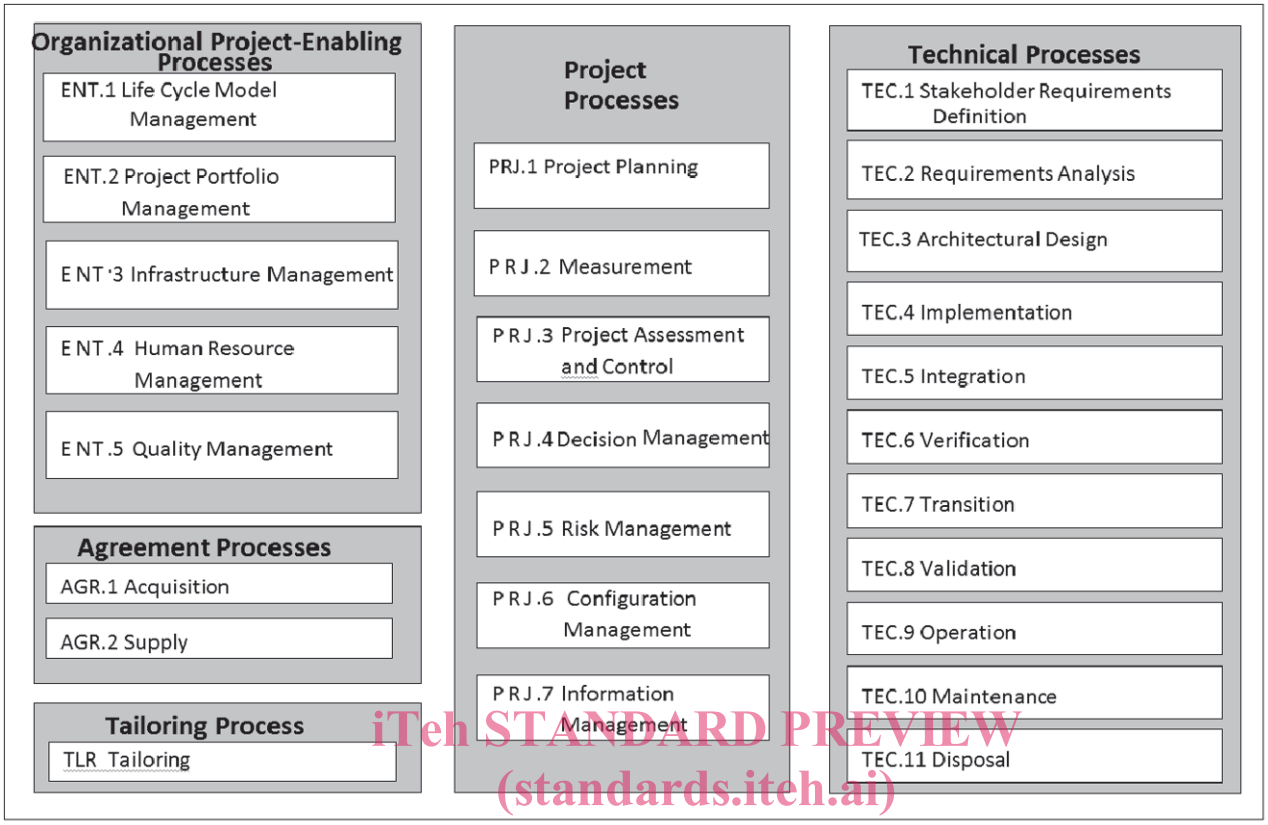

Figure 2 — Process Grouping

Figure 2 lists the processes from ISO/IEC 15288, which are included in the process dimension of the exemplar System Life Cycle Process Assessment Model.

Each Process Group includes a list of the processes it contains. Each process is identified with a Process Identifier [ID] consisting of the Group abbreviated name and a sequential number of the process in that Group.

The Process Groups are described in more detail below.

4.2.1.1 Agreement System Life Cycle Process Group

The Agreement process group consists of processes performed in order to establish agreements with organizational entities external and internal to the organization. These processes define the activities necessary to establish an agreement between two organizations. Invocation of the Acquisition Process provides the means for conducting business with a supplier of products that are supplied for use as an operational system, of services in support of an operational system, or of elements of a system being developed by a project. Invocation of the Supply Process provides the means for conducting a project in which the result is a product or service that is delivered to the acquirer.

This group includes the processes listed in Table 1.

Table 1 — Agreement System Life Cycle Process Group

Process Identification	Process name
AGR.1	Acquisition Process
AGR.2	Supply Process

4.2.1.2 Enterprise System Life Cycle Process Group

The Enterprise process group consists of processes performed in order to manage the organization's capability to acquire and supply products or services through the initiation, support and control of projects. They provide resources and infrastructure necessary to support projects and ensure the satisfaction of organizational objectives and established agreements. They are not intended to be a comprehensive set of business processes that enable strategic management of the organization's business.

This group includes the processes listed in Table 2.

Table 2 — Organizational Project-Enabling System Life Cycle Process Group

Process Identification	Process name
ENT.1	Life Cycle Model Management Process
ENT.2	Project Portfolio Management Process
ENT.3	Infrastructure Management Process
ENT.4	Human Resource Management Process
ENT.5	Quality Management Process

4.2.1.3 Project System Life Cycle Process Group

The Project process group consists of processes performed in order to establish and evolve project plans, to assess actual achievement and progress against the plans and to control execution of the project through to fulfilment. Individual Project Processes may be invoked at any time in the life cycle and at any level in a hierarchy of projects, as required by project plans or unforeseen events. The Project Processes are applied with a level of rigour and formality that depends on the risk and complexity of the project.

This group includes the processes listed in Table 3.

Table 3 — Project System Life Cycle Process Group

Process Identification	Process name
PRJ.1	Project Planning Process
PRJ.2	Measurement Process
PRJ.3	Project Assessment and Control Process
PRJ.4	Decision Management Process
PRJ.5	Risk Management Process
PRJ.6	Configuration Management Process
PRJ.7	Information Management Process

4.2.1.4 Technical System Life Cycle Process Group

The Technical process group consists of processes performed in order to define the requirements for a system; to transform the requirements into an effective product; to permit consistent reproduction of the product where necessary; to use a product to provide the required services; to sustain the provision of those services; and to dispose of the product when it is retired from service.

This group includes the processes listed in Table 4.

The Technical Processes define the activities that enable enterprise and project functions to optimize the benefits and reduce the risks that arise from technical decisions and actions. These activities enable products and services to possess the timeliness and availability, the cost effectiveness, and the functionality, reliability, maintainability, producibility, usability and other qualities required by acquiring and supplying organizations. They also enable products and services to conform to the expectations or legislated requirements of society, including health, safety, security and environmental factors.

Table 4 —Technical System Life Cycle Process Group

Process Identification	Process name
TEC.1	Stakeholder Requirements Definition Process
TEC.2	Requirements Analysis Process
TEC.3	Architectural Design Process
TEC.4	Implementation Process
TEC.5	Integration Process
TEC.6	Verification Process
TEC.7	Transition Process
TEC.8	Validation Process
TEC.9	Operation Process
TEC.10	Maintenance Process
TEC.11	Disposal Process

4.2.1.5 Tailoring Process

The Tailoring Process is performed in order to adapt the system life cycle processes of ISO/IEC 15288 and to define the life cycle stages that describe a life cycle model appropriate to particular circumstances of an organization. This process is derived from the requirements of the System Life Cycle Processes Management Process.

4.2.2 Process dimension

The process dimension of the Process Assessment Model includes all processes listed in Figure 2. The processes are classified into 5 Process Groups. Each process in the Process Assessment Model is described in terms of a purpose statement. These statements contain the unique functional objectives of the process when performed in a particular environment. A list of specific outcomes is associated with each of the process purpose statements, as a list of expected positive results of the processes' performance.

Satisfying the purpose statements of a process represents the first step in building a level 1 process capability where the expected outcomes are observable. The Process Groups and their associated processes are described in Clause 5.

4.2.3 Capability dimension

For the capability dimension, the process capability levels and process attributes are identical to those defined in ISO/IEC 15504-2.

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

A capability level is a set of process attribute(s) that work together to provide a major enhancement in the capability to perform a process. The levels constitute a rational way of progressing through improvement of the capability of any process and are defined in ISO/IEC 15504-2.

There are six capability levels, incorporating nine process attributes.

Level 0: Incomplete process

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

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

Level 1: Performed process

The implemented process achieves its process purpose.

Level 2: Managed process

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

Level 3: Established process

The previously described Managed process is now implemented using a defined process that is capable of achieving its process outcomes.

Level 4: Predictable process

The previously described Established process now operates within defined limits to achieve its process outcomes.

Level 5: Optimizing process

The previously described Predictable process is continuously improved to meet relevant current and projected business goals.

Within the Process Assessment Model, the measure of capability is based upon the nine process attributes (PA) defined in ISO/IEC 15504-2. Process attributes are used to determine whether a process has reached a given capability. Each attribute measures a particular aspect of the process capability.

At each level there is no ordering between the process attributes; each attribute addresses a specific aspect of the capability level. The list of process attributes is shown in Table 5.