TECHNICAL REPORT

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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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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.

In exceptional circumstances, the joint technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when the joint technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

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 TR 15504-6, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems enginering*.

ISO/IEC TR 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 Process Assessment Model*

— *Part 6: An exemplar system life cycle process assessment model* [Technical Report]

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 15288:2002 has been used as the basis for the Process Assessment Model in this part of ISO/IEC 15504. Relevant material from ISO/IEC 15288:2002 is included in this Technical Report, and it is not necessary to refer to ISO/IEC 15288 in order to use this Technical Report. After evaluation of this Technical Report in use, it will be amended to reflect the current version of ISO/IEC 15288.

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 ISO/IEC 15504-5. It may be used in conjunction with ISO/IEC 15504-5 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/IEC 15289:2006, *Systems and software engineering — Content of systems and software life cycle process information products (Documentation)* as the basis for the Generic Work Products.

This part of ISO/IEC 15504 is structured as follows.

— 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.

— 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

- defines an exemplar Process Assessment Model that meets the requirements of ISO/IEC 15504-2 and that supports the performance of an assessment by providing indicators for guidance on the interpretation of the process purposes and outcomes as defined in ISO/IEC 15288 and the process attributes as defined in ISO/IEC 15504-2;
- provides guidance, by example, on the definition, selection and use of assessment indicators.

A process assessment model comprises a set of indicators of process performance and process capability. The indicators are used as a basis for collecting the objective evidence that enables an assessor to assign ratings. The set of indicators included in this part of ISO/IEC 15504 is not intended to be an all-inclusive set nor is it intended to be applicable in its entirety. Subsets that are appropriate to the context and scope of the assessment should be selected, and possibly augmented with additional indicators (see Annex C).

The Process Assessment Model in this part of ISO/IEC 15504 is directed at assessment sponsors and competent assessors who wish to select a model, and associated documented process method, for assessment (for either capability determination or process improvement). Additionally it may be of use to developers of assessment models in the construction of their own model, by providing examples of good systems engineering and management practices.

Any process assessment model meeting the requirements defined in ISO/IEC 15504-2 concerning models for process assessment may be used for assessment. Different models and methods may be needed to address differing business needs. The assessment model in this part of ISO/IEC 15504 is provided as an exemplar of a model meeting all the requirements expressed in ISO/IEC 15504-2.

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

NOTE: **Copyright release for the Exemplar Process Assessment Model:** Users of this part of ISO/IEC 15504 may 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 referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 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.

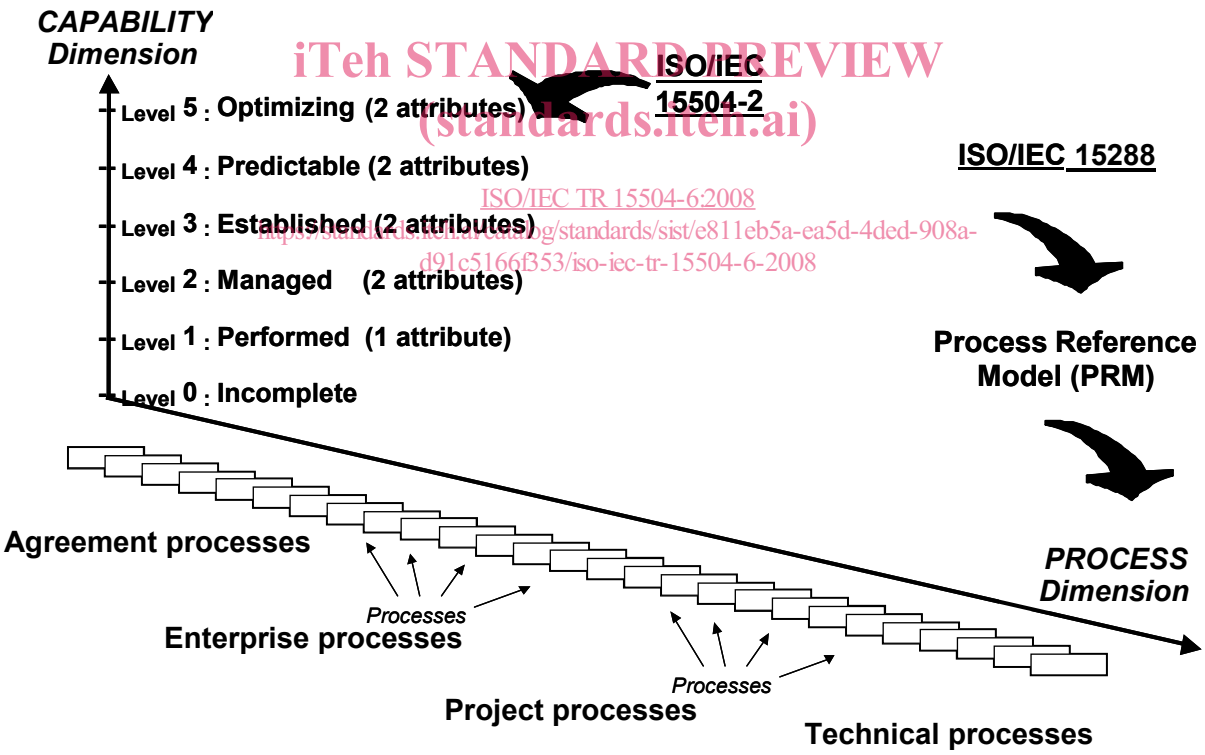

Figure 1 — Relationship between the Process Assessment Model and its inputs

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

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

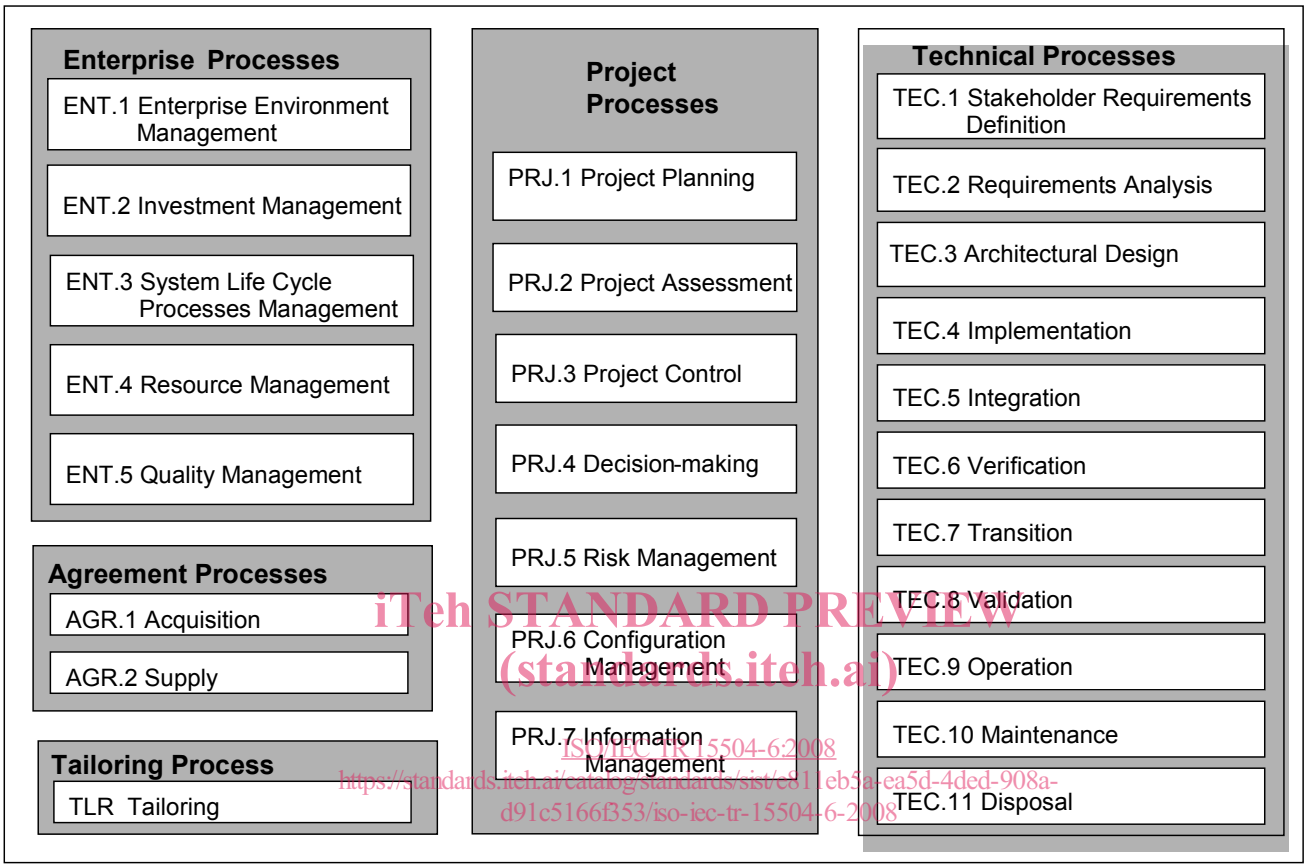

Figure 2 — Process Grouping

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 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.

4.2.1.2 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

4.2.1.3 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 — Enterprise System Life Cycle Process Group

Process Identification	Process name
ENT.1	Enterprise Environment Management Process
ENT.2	Investment Management Process
ENT.3	Systems Life Cycle Process Management Process
ENT.4	Resource Management Process
ENT.5	Quality Management Process

4.2.1.4 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	Project Assessment Process
PRJ.3	Project Control Process
PRJ.4	Decision-making Process
PRJ.5	Risk Management Process
PRJ.6	Configuration Management Process
PRJ.7	Information Management Process

4.2.1.5 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.

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.

This group includes the processes listed in Table 4.

Table 4 —Technical System Life Cycle Process Group

Process Identification	Process name
TEC.1	Stakeholder Requirements Management 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

4.2.2 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.