

# Information technology — Software process assessment —

## Part 5: An assessment model and indicator guidance

ICS 35.080

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# National foreword

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### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ISO/IEC TR title page, pages ii to vi, pages 1 to 116 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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# Contents

|                            |                    |
|----------------------------|--------------------|
|                            | Page               |
| National foreword          | Inside front cover |
| Foreword                   | vi                 |
| Text of ISO/IEC TR 15504-5 | 1                  |



# TECHNICAL REPORT

# ISO/IEC TR 15504-5

First edition  
1999-05-01

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## Information technology — Software process assessment —

### Part 5: An assessment model and indicator guidance

*Technologies de l'information — Évaluation de processus de logiciel —  
Partie 5: Un modèle d'évaluation et guide des indicateurs*



## Contents

|                                                                   | Page |
|-------------------------------------------------------------------|------|
| Foreword                                                          | vi   |
| Introduction                                                      | 1    |
| 1 Scope                                                           | 1    |
| 2 Normative references                                            | 2    |
| 3 Terms and definitions                                           | 2    |
| 4 Overview of the exemplar assessment model                       | 2    |
| 4.1 Introduction                                                  | 2    |
| 4.2 Structure of the assessment model                             | 3    |
| 4.2.1 Indicators of process performance — the process dimension   | 4    |
| 4.2.2 Indicators of process capability — the capability dimension | 4    |
| 4.3 Principles of the assessment model                            | 5    |
| 4.4 The view of process performance — the process dimension       | 5    |
| 4.5 The view of process capability — the capability dimension     | 5    |
| 4.6 Use of indicators in rating processes                         | 7    |
| 4.7 Identification                                                | 8    |
| 4.7.1 Identification for elements of the assessment model         | 8    |
| 4.7.2 Work product identification                                 | 9    |
| 5 The process dimension                                           | 9    |
| 5.1 Primary life cycle processes                                  | 11   |
| 5.1.1 Customer-Supplier Process Category (CUS)                    | 11   |
| 5.1.2 Engineering process category (ENG)                          | 16   |
| 5.2 Supporting life cycle processes                               | 22   |
| 5.2.1 Support process category (SUP)                              | 22   |
| 5.3 Organizational life cycle processes                           | 28   |
| 5.3.1 Management process category (MAN)                           | 28   |
| 5.3.2 Organization process category (ORG)                         | 32   |
| 6 The capability dimension                                        | 38   |
| 6.1 Level 0: Incomplete process                                   | 38   |
| 6.2 Level 1: Performed process                                    | 39   |
| 6.2.1 PA 1.1 Process performance attribute                        | 39   |
| 6.3 Level 2: Managed process                                      | 39   |
| 6.3.1 PA 2.1 Performance management attribute                     | 39   |
| 6.3.2 PA 2.2 Work product management attribute                    | 39   |
| 6.4 Level 3: Established process                                  | 40   |
| 6.4.1 6PA 3.1 Process definition attribute                        | 40   |
| 6.4.2 PA 3.2 Process resource attribute                           | 40   |
| 6.5 Level 4: Predictable process                                  | 40   |
| 6.5.1 PA 4.1 Measurement attribute                                | 41   |
| 6.5.2 PA 4.2 Process control attribute                            | 41   |
| 6.6 Level 5: Optimizing process                                   | 41   |
| 6.6.1 PA 5.1 Process change attribute                             | 41   |
| 6.6.2 PA 5.2 Continuous improvement attribute                     | 42   |
| 7 Compatibility with the reference model                          | 42   |
| 7.1 Introduction                                                  | 42   |
| 7.2 Model purpose                                                 | 42   |
| 7.3 Model scope                                                   | 43   |
| 7.4 Model elements and indicators                                 | 43   |
| 7.5 Mapping                                                       | 43   |
| 7.6 Translation                                                   | 44   |

|                                                                                                       | Page |
|-------------------------------------------------------------------------------------------------------|------|
| Annex A (informative) Processes and associated work products                                          | 45   |
| Annex B (informative) Indicators of process capability                                                | 62   |
| Annex C (informative) Work products and their characteristics                                         | 87   |
| Annex D (informative) Style guide for defining base practices                                         | 113  |
| Annex E (informative) Style guide for defining management practices                                   | 114  |
| Bibliography                                                                                          | 116  |
| Figure 1 — The relationship between the reference model, the assessment model, and assessment methods | 3    |
| Figure 2 — Relationship between the reference model and the assessment model                          | 4    |
| Figure 3 — The relationship between assessment indicators and process capability                      | 8    |
| Table 1 — Capability levels and process attributes                                                    | 7    |
| Table 2 — Processes and process categories                                                            | 10   |
| Table A.1 — CUS.1.1 — Acquisition Preparation Process — Associated Work Products                      | 45   |
| Table A.2 — CUS.1.2 — Supplier Selection Process — Associated Work Products                           | 45   |
| Table A.3 — CUS.1.3 — Supplier Monitoring Process — Associated Work Products                          | 46   |
| Table A.4 — CUS.1.4 — Customer Acceptance Process — Associated Work Products                          | 46   |
| Table A.5 — CUS.2 — Supply process — Associated Work Products                                         | 46   |
| Table A.6 — CUS.3 — Requirements elicitation process — Associated Work Products                       | 47   |
| Table A.7 — CUS.4.1 — Operational use process — Associated Work Products                              | 47   |
| Table A.8 — CUS.4.2 — Customer support process — Associated Work Products                             | 48   |
| Table A.9 — ENG.1.1 — System requirements analysis and design process — Associated Work Products      | 48   |
| Table A.10 — ENG.1.2 — Software requirements analysis process — Associated Work Products              | 48   |
| Table A.11 — ENG.1.3 — Software design process — Associated Work Products                             | 49   |
| Table A.12 — ENG.1.4 — Software construction process — Associated Work Products                       | 49   |
| Table A.13 — ENG.1.5 — Software integration process — Associated Work Products                        | 49   |
| Table A.14 — ENG.1.6 — Software testing process — Associated Work Products                            | 49   |
| Table A.15 — ENG.1.7 — System integration and testing process — Associated Work Products              | 50   |
| Table A.16 — ENG.2 — System and software maintenance process — Associated Work Products               | 50   |
| Table A.17 — SUP.1 — Documentation Process — Associated Work Products                                 | 51   |
| Table A.18 — SUP.2 — Configuration Management Process — Associated Work Products                      | 52   |
| Table A.19 — SUP.3 — Quality Assurance Process — Associated Work Products                             | 52   |

|                                                                                   | Page |
|-----------------------------------------------------------------------------------|------|
| Table A.20 — SUP.4 — Verification Process — Associated Work Products              | 52   |
| Table A.21 — SUP.5 — Validation Process — Associated Work Products                | 53   |
| Table A.22 — SUP.6 — Joint Review Process — Associated Work Products              | 53   |
| Table A.23 — SUP.7 — Audit Process — Associated Work Products                     | 54   |
| Table A.24 — SUP.8 — Problem Resolution Process — Associated Work Products        | 55   |
| Table A.25 — MAN.1 — Management Process — Associated Work Products                | 55   |
| Table A.26 — MAN.2 — Project management process — Associated Work Products        | 56   |
| Table A.27 — MAN.3 — Manage quality — Associated Work Products                    | 56   |
| Table A.28 — MAN.4 — Manage risks — Associated Work Products                      | 57   |
| Table A.29 — ORG.1 — Organizational alignment process — Associated Work Products  | 57   |
| Table A.30 — ORG.2.1 — Process establishment process — Associated Work Products   | 58   |
| Table A.31 — ORG.2.2 — Process assessment process — Associated Work Products      | 58   |
| Table A.32 — ORG.2.3 — Process improvement process — Associated Work Products     | 59   |
| Table A.33 — ORG.3 — Human resource management process — Associated Work Products | 60   |
| Table A.34 — ORG.4 — Infrastructure process — Associated Work Products            | 60   |
| Table A.35 — ORG.5 — Measurement Process — Associated Work Products               | 61   |
| Table A.36 — ORG.6 — Reuse Process — Associated Work Products                     | 61   |
| Table B.1 — Management practice 1.1.1                                             | 62   |
| Table B.2 — Management Practice 1.1.2                                             | 63   |
| Table B.3 — Management Practice 1.1.3                                             | 63   |
| Table B.4 — Management practice 2.1.1                                             | 63   |
| Table B.5 — Management practice 2.1.2                                             | 64   |
| Table B.6 — Management practice 2.1.3                                             | 65   |
| Table B.7 — Management practice 2.1.4                                             | 66   |
| Table B.8 — Management Practice 2.2.1                                             | 67   |
| Table B.9 — Management practice 2.2.2                                             | 67   |
| Table B.10 — Management practice 2.2.3                                            | 69   |
| Table B.11 — Management practice 2.2.4                                            | 69   |
| Table B.12 — Management practice 3.1.1                                            | 70   |
| Table B.13 — Management practice 3.1.2                                            | 71   |
| Table B.14 — Management practice 3.1.3                                            | 72   |
| Table B.15 — Management practice 3.1.4                                            | 72   |
| Table B.16 — Management practice 3.1.5                                            | 72   |
| Table B.17 — Management practice 3.2.1                                            | 73   |
| Table B.18 — Management practice 3.2.2                                            | 73   |
| Table B.19 — Management practice 3.2.3                                            | 74   |

|                                                             | Page |
|-------------------------------------------------------------|------|
| Table B.20 — Management practice 3.2.4                      | 74   |
| Table B.21 — Management practice 4.1.1                      | 75   |
| Table B.22 — Management practice 4.1.2                      | 76   |
| Table B.23 — Management practice 4.1.3                      | 76   |
| Table B.24 — Management practice 4.1.4                      | 77   |
| Table B.25 — Management practice 4.2.1                      | 78   |
| Table B.26 — Management practice 4.2.2                      | 79   |
| Table B.27 — Management practice 4.2.3                      | 79   |
| Table B.28 — Management Practice 5.1.1                      | 80   |
| Table B.29 — Management practice 5.1.2                      | 81   |
| Table B.30 — Management practice 5.1.3                      | 81   |
| Table B.31 — Management practice 5.1.4                      | 82   |
| Table B.32 — Management practice 5.1.5                      | 83   |
| Table B.33 — Management practice 5.2.1                      | 84   |
| Table B.34 — Management practice 5.2.2                      | 84   |
| Table B.35 — Management practice 5.2.3                      | 85   |
| Table B.36 — Management practice 5.2.4                      | 86   |
| Table C.1 — Work Product Classification                     | 87   |
| Table C.2 — Key work product characteristics                | 88   |
| Table D.1 — Guide-lines for describing Base Practices       | 114  |
| Table E.1 — Guide-lines for describing management practices | 115  |

## 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.

The main task of technical committees is to prepare International Standards, but in exceptional circumstances a 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, where a 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.

ISO/IEC TR 15504-5, which is a Technical Report of type 2, was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC7, *Software engineering*.

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

- *Part 1: Concepts and introductory guide*;
- *Part 2: A reference model for processes and process capability*;
- *Part 3: Performing an assessment*;
- *Part 4: Guide to performing assessments*;
- *Part 5: An assessment model and indicator guidance*;
- *Part 6: Guide to competency of assessors*;
- *Part 7: Guide for use in process improvement*;
- *Part 8: Guide for use in determining supplier process capability*;
- *Part 9: Vocabulary*.

Annex A to Annex E of this part of ISO/IEC TR 15504 are for information only.

## Introduction

This part of ISO/IEC TR 15504 provides an example of assessment model for supporting process assessment. It also contains guidance of good software engineering practices to be considered when interpreting the intent of the reference model defined in ISO/IEC TR 15504-2. This guidance is provided in the form of indicators contained in this assessment model. These indicators may also be used when performing a process improvement program or to help evaluate and select an assessment model, method, methodology or tools.

An integral part of conducting an assessment is to use a model constructed for that purpose, compatible with the reference model defined in ISO/IEC TR 15504-2. The reference model cannot be used alone as the basis for conducting reliable and consistent assessments of process capability since the level of detail is not sufficient. The descriptions of process purpose and capability attributes in the reference model need to be supported with a comprehensive set of indicators of process performance and process capability. Used in this way, in conjunction with a reliable method, consistent and repeatable ratings of process capability will be possible.

This assessment model is compatible with the reference model described in ISO/IEC TR 15504-2. As an example, it embodies the core characteristics that could be expected of any compatible assessment model. Use of this assessment model is not required to meet the requirements of this ISO/IEC TR 15504; other models meeting the requirements of ISO/IEC TR 15504-2 may be used in a conformant assessment.

Within this part of ISO/IEC TR 15504:

- clause 4 provides a detailed description of the structure and key components of the assessment model;
- clause 5 uses the definitions from ISO/IEC TR 15504-2, categorizing processes into 3 life cycle process groupings, five process categories and describing each process in terms of its purpose. It expands these definitions by including a set of base practices for each process. Annex A is directly linked to this clause as it continues the work of defining indicators of process performance by associating work products with each process. Annex C is also linked directly to Annex A as it defines the work product characteristics;
- clause 6 repeats the definitions of the capability levels and process attributes from ISO/IEC TR 15504-2, that describe the capability of processes. It expands these definitions through the inclusion of sets of management practices for each attribute. Annex B is directly linked to this clause as it completes the work of defining indicators of process capability by associating practice performance characteristics and, resource and infrastructure characteristics to each management practices;
- clause 7 contains a declaration that the assessment model is compatible with the reference model and fully meets the requirements defined in ISO/IEC TR 15504-2;
- Annex A contains the input and output work products associated with each process in this assessment model;
- Annex B contains the process performance, resources and infrastructure characteristics and related processes associated with each management practice;
- Annex C contains the characteristics for each work product;
- Annex D contains a style guide for defining base practices;
- Annex E contains a style guide for defining management practices;
- the Bibliography contains a list of informative references.

Annex A to Annex E of this part of ISO/IEC TR 15504 are for information only.

## 1 Scope

This part of ISO/IEC TR 15504:

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

Any model meeting the requirements of ISO/IEC TR 15504-2 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 TR 15504 is provided as an example of a compatible model.

The indicators are used as guides in collecting the objective evidence that enables an assessor to assign ratings to process attributes. The set of indicators included in this part of ISO/IEC TR 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.

By providing the assessment model, this part of ISO/IEC TR 15504 is directed at assessment sponsors and competent assessors who wish to select a model, and associated method, for assessment (for either capability determination or process improvement). Additionally it may be of use to model developers in the construction of a compatible model, by providing examples of good software engineering practice.

## 2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC TR 15504. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC TR 15504 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC TR 15504-2:1998, *Information technology — Software process assessment — Part 2: A reference model for processes and process capability*.

ISO/IEC TR 15504-9:1998, *Information technology — Software process assessment — Part 9: Vocabulary*.

## 3 Terms and definitions

For the purposes of this part of ISO/IEC TR 15504, the terms and definitions given in ISO/IEC TR 15504-9 and the following definitions apply.

### 3.1

#### **attribute indicator**

an *assessment indicator* that supports the judgement of the extent of achievement of a specific *process attribute*

### 3.2

#### **base practice**

a software engineering or management activity that, when consistently performed, contributes to achieve the purpose of a particular process

### 3.3

#### **management practice**

a management activity or task that addresses the implementation or institutionalisation of a specific process attribute

### 3.4

#### **tailored process**

a defined process developed by tailoring a standard process definition

## 4 Overview of the exemplar assessment model

### 4.1 Introduction

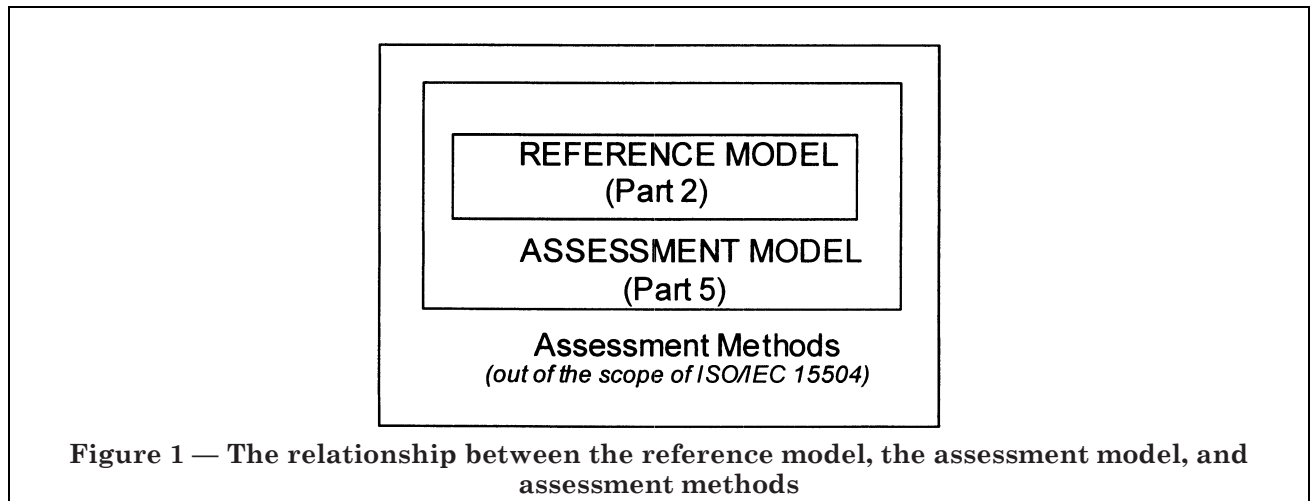
This part of ISO/IEC TR 15504 provides an exemplar assessment model that includes examples of appropriate indicators.

The reference model defined in ISO/IEC TR 15504-2 provides a common basis for performing assessments of software process capability, allowing for the reporting of results using a common rating scale.

The reference model defines a two-dimensional model of process capability. In one dimension, the process dimension, the processes associated with software are defined and classified into five process categories. In the second dimension, the capability dimension, a series of process attributes grouped into capability levels are defined. The process attributes provide the measurable characteristics of process capability.

The reference model 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 process attributes in the reference model need to be supported with comprehensive sets of indicators of process performance and capability.

The exemplar assessment model defined in this part of ISO/IEC TR 15504 is based upon and is compatible with the reference model, and can be used as the basis for conducting an assessment of software process capability.

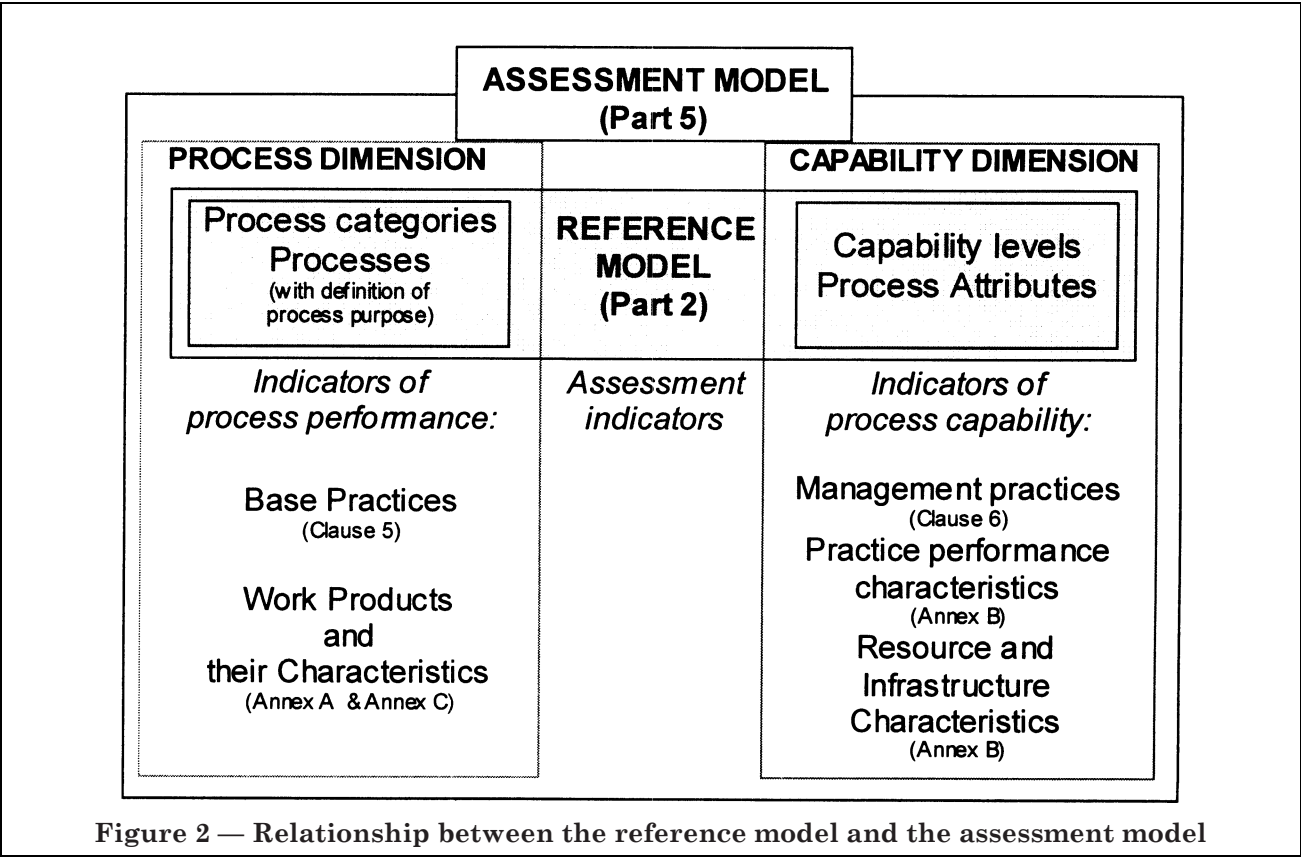


In order to meet the requirements of ISO/IEC TR 15504, a documented process supporting the requirements of ISO/IEC TR 15504-3 is also required. This need may be met, for example, by the adoption of a supportive method for conducting assessments (see Figure 1). The definition of an example method is outside the scope of this part of ISO/IEC TR 15504.

#### 4.2 Structure of the assessment model

This clause describes the structure of the model and its key components. Clause 5, together with its associated Annex A and Annex C, describes the components of the process dimension and clause 6, with its associated Annex B, describes the components of the capability dimension. Clause 7 provides a demonstration of compatibility that fully meets the requirements of ISO/IEC TR 15504-2.

The basic structure of this assessment model is identical to that of the reference model defined in ISO/IEC TR 15504-2. There is a one to one correspondence between the process categories, processes, purpose statements, process capability levels and process attributes of the reference model and those of this assessment model.



This assessment model expands the reference model by adding the definition and use of assessment indicators (see Figure 2). Assessment indicators are defined to support an assessor’s judgement of the performance and capability of an implemented process.

**4.2.1 Indicators of process performance — the process dimension**

Base practices, input and output work products and their associated characteristics relate to the processes defined in the process dimension of the reference model, and are chosen to explicitly address the achievement of the defined process purpose.

The base practices and work products are indicators of a level 1 process performance. The presence of the work products with the existence of the characteristics of the work products, and evidence of performance of the base practices, provide objective evidence of the achievement of the purpose of the process.

**4.2.2 Indicators of process capability — the capability dimension**

Management practices relate to the process attributes defined in the process capability dimension of the reference model. Evidence of their effective performance supports the judgement of the degree of achievement of the attribute. Management practices are the principal indicators of process capability.

Management practices are linked with attribute indicator sets which are:

- a) practice performance characteristics that provide guidance on the implementation of the practice;
- b) resource and infrastructure characteristics that provide mechanisms for assisting in the management of the process; and
- c) associated processes from the process dimension that support the management practice.

The set of management practices is intended to be applicable to all processes in the process dimension of the model. Evidence of the performance of the defined management practices can be derived from the practice performance characteristics. The practice performance characteristics and resource & infrastructure characteristics help to establish objective evidence of the extent of achievement of the specified process attribute.

### 4.3 Principles of the assessment model

The assessment model is based on the principle that the capability of a process can be assessed by demonstrating the achievement of process attributes. Each process in the process dimension has a set of associated base practices, the performance of which provides an indication of the extent of achievement of the process purpose. Similarly, each process attribute in the capability dimension has a set of associated management practices, the performance of which provides an indication of the extent of achievement of the attribute in the instantiated process.

The indicators defined in the assessment model represent types of objective evidence that might be found in an instantiation of a process and therefore could be used to judge achievement of capability.

### 4.4 The view of process performance — the process dimension

The assessment model groups the processes in the process dimension into five process categories, according to the type of activity they address. The groupings are identical to those in the reference model defined in ISO/IEC TR 15504-2.

The **Customer-Supplier** process category (CUS) consists of processes that directly impact the customer, support development and transition of the software to the customer, and provide for the correct operation and use of the software product and/or service.

The **Engineering** process category (ENG) consists of processes that directly specify, implement, or maintain the software product, its relation to the system and its customer documentation.

The **Support** process category (SUP) consists of processes which may be employed by any of the other processes (including other supporting processes) at various points in the software life cycle.

The **Management** process category (MAN) consists of processes which contain practices of a generic nature which may be used by anyone who manages any type of project or process within a software life cycle.

The **Organization** process category (ORG) consists of processes that establish the business goals of the organization and develop process, product, and resource assets which, when used by the projects in the organization, will help the organization achieve its business goals.

There are a number of processes associated with each process category. Each process in the assessment model is described in terms of a purpose statement. These statements contain the unique functional objectives of the process when instantiated in a particular environment. Satisfying the purpose statements of a process represents the first step in building a level 1 process capability. The process categories and their associated processes are described in Clause 5.

A base practice is an activity that addresses the purpose of a particular process. Consistently performing the base practices associated with a process will help to consistently achieve its purpose. A coherent set of base practices is associated with each process in the process dimension.

The base practices are described at an abstract level, identifying “what” should be done without specifying “how”. Implementing only the base practices of a process may be of minimal value and represents only the first step in building process capability, but the base practices represent the unique, functional activities of the process, even if that performance is not systematic. Performance of the base practices may be ad hoc, unpredictable, inconsistent, poorly planned, and/or result in products that do not meet their requirements. The performance of a process, however, produces work products that are at least marginally usable in achieving the purpose of the process. In this assessment model, each work product has a defined set of characteristics that may be used to assess the effective implementation of a process.

Clause 5 contains a complete description of the base practices. Annex A lists the processes and their related work products. Annex C lists the key characteristics of the work products.

### 4.5 The view of process capability — the capability dimension

Evolving process capability is expressed in the assessment model in terms of process attributes grouped into capability levels. The attributes and capability levels are identical to those defined in the reference model.

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. Each level provides a major enhancement of capability in the performance of a process. The levels constitute a rational way of progressing through improvement of the capability of any process and are defined in ISO/IEC TR 15504-2.

There are six capability levels in the reference model, incorporating nine process attributes.

**Level 0: Incomplete.** There is general failure to attain the purpose of the process. There are little or no easily identifiable work products or outputs of the process.

**Level 1: Performed.** The purpose of the process is generally achieved. The achievement may not be rigorously planned and tracked. Individuals within the organization recognise that an action should be performed, and there is general agreement that this action is performed as and when required. There are identifiable work products for the process, and these testify to the achievement of the purpose.

**Level 2: Managed.** The process delivers work products according to specified procedures and is planned and tracked. Work products conform to specified standards and requirements. The primary distinction from the Performed Level is that the performance of the process now delivers work products that fulfil expressed quality requirements within defined timescales and resource needs.

**Level 3: Established.** The process is performed and managed using a defined process based upon good software engineering principles. Individual implementations of the process use approved, tailored versions of standard, documented processes to achieve the defined process outcomes. The resources necessary to establish the process definition are also in place. The primary distinction from the Managed Level is that the process of the Established Level is using a defined process that is capable of achieving its defined process outcomes.

**Level 4: Predictable.** The defined process is performed consistently in practice within defined control limits, to achieve its defined process goals. Detailed measures of performance are collected and analyzed. This leads to a quantitative understanding of process capability and an improved ability to predict and manage performance. Performance is quantitatively managed. The quality of work products is quantitatively known. The primary distinction from the Established Level is that the defined process is now performed consistently within defined limits to achieve its defined process outcomes.

**Level 5: Optimizing.** Performance of the process is optimized to meet current and future business needs, and the process achieves repeatability in meeting its defined business goals. Quantitative process effectiveness and efficiency goals (targets) for performance are established, based on the business goals of the organization. Continuous process monitoring against these goals is enabled by obtaining quantitative feedback and improvement is achieved by analysis of the results. Optimizing a process involves piloting innovative ideas and technologies and changing non-effective processes to meet defined goals or objectives. The primary distinction from the Predictable Level is that the defined and standard processes now dynamically change and adapt to effectively meet current and future business goals.

Within the assessment model, the measure of capability is based upon the nine process attributes (PA) of the reference model. 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 process attributes themselves are evaluated on a four point ordinal scale of achievement, as defined in ISO/IEC TR 15504-2. They therefore provide insight into the specific aspects of process capability required to support process improvement and capability determination. The list of process attributes is shown in Table 1.

**Table 1 — Capability levels and process attributes**

| Process Attribute ID | Capability Levels and Process Attributes |
|----------------------|------------------------------------------|
|                      | <b>Level 0: Incomplete process</b>       |
|                      | <b>Level 1: Performed process</b>        |
| PA 1.1               | Process performance                      |
|                      | <b>Level 2: Managed process</b>          |
| PA 2.1               | Performance management                   |
| PA 2.2               | Work product management                  |
|                      | <b>Level 3: Established process</b>      |
| PA 3.1               | Process definition                       |
| PA 3.2               | Process resource                         |
|                      | <b>Level 4: Predictable process</b>      |
| PA 4.1               | Measurement                              |
| PA 4.2               | Process control                          |
|                      | <b>Level 5: Optimizing process</b>       |
| PA 5.1               | Process change                           |
| PA 5.2               | Continuous improvement                   |

The management practices are activities of a generic type, and are intended to be applicable to all processes. They are designed around the achievement of the principal management functions of planning, organizing, resourcing and controlling. There are usually, but not necessarily, four management practices for each attribute.

Associated with each management practice are practice performance characteristics and associated resource and infrastructure characteristics that represent the type of evidence that would substantiate judgements of the extent to which the management practice is performed.

Annex B contains a complete description of the set of indicators of process capability.

#### 4.6 Use of indicators in rating processes

An indicator is defined as an objective attribute or characteristic of a practice or work product that supports the judgement of the performance or capability of an implemented process. The assessment indicators, and their relationship to process performance and process capability, are shown in Figure 3.

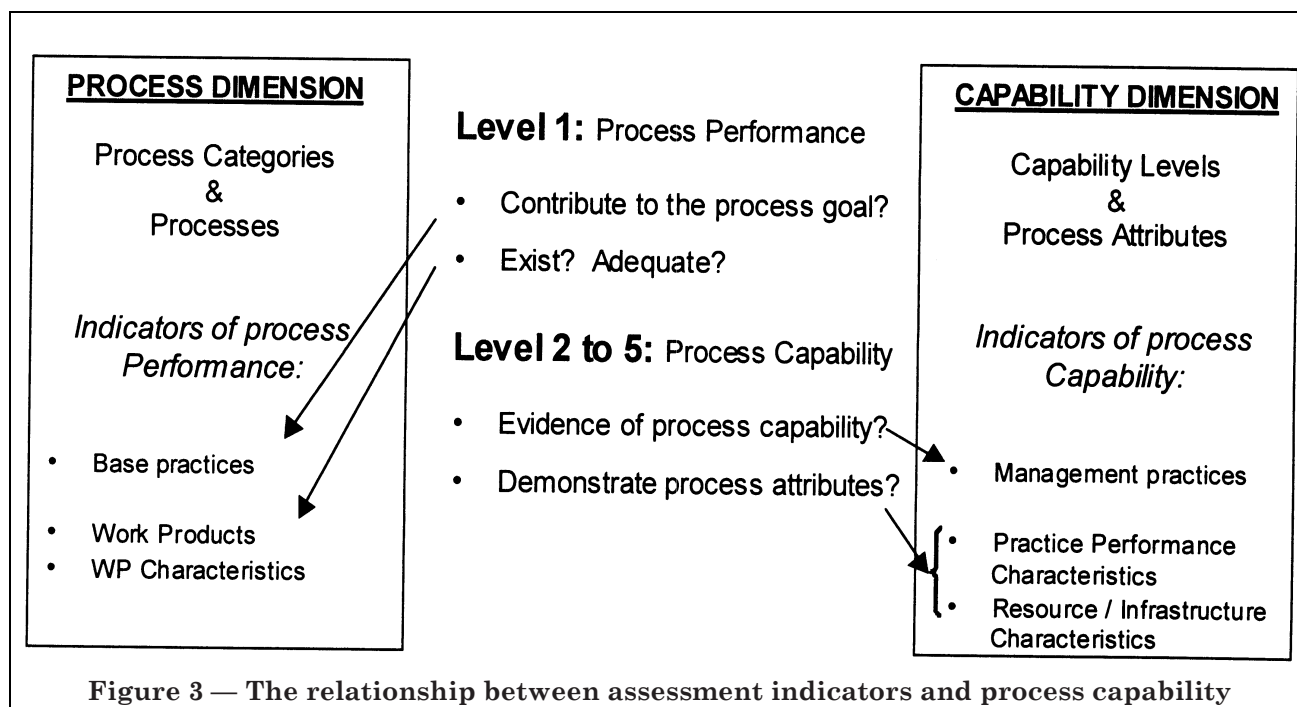
The output from a process assessment is a set of process profiles, one for each instance of each process within the scope of the assessment. Each process profile consists of a set of the process attribute ratings for an assessed process. Each attribute rating represents a judgement by the assessor of the extent to which the attribute is achieved. In order to maximise the objectivity of these judgements, thereby improving the reliability and repeatability of the assessment, the judgements of the assessor are based upon a coherent set of documented objective evidence.

The indicators in this model give examples of evidence that an assessor might obtain, or observe, in the course of an assessment. The evidence obtained in the assessment, through observation of the implemented process, can be mapped onto the set of indicators to enable correlation between the implemented process and the processes defined in this assessment model. These indicators provide guidance for assessors in accumulating the necessary objective evidence to support their judgements of capability. They are not intended to be regarded as a mandatory set of check-list to be followed, but as guidance for an assessor in accumulating the necessary objective evidence to support their judgement of capability.

The evidence obtained should be recorded in a form that clearly identifies the indicators types and classes, so that the support for the assessor's judgement can be readily confirmed or verified as required by ISO/IEC TR 15504-3.

Indicators are used to confirm that certain practices are performed, having been able to collect possible objective evidence during an assessment. All such evidence comes either from the examination of work products of the processes assessed, or from statements made by the performers and managers of the processes.

The existence of base practices, work products, and work product characteristics, provide evidence of the performance of the processes associated with them. Similarly, the existence of management practices provides evidence of process capability.



## 4.7 Identification

### 4.7.1 Identification for elements of the assessment model

A nomenclature for practices is defined in order to identify them unambiguously and relate them to the architecture of the model. The nomenclature for base practices facilitates the identification of process categories, the processes that belong to each process category, and the base practices that belong to each process. For management practices, the nomenclature facilitates the identification of capability levels, the process attributes that belong to each capability level, and the management practices that belong to each process attribute. In software process assessments using the assessment model, the nomenclature and identifiers contained in this model should be used to identify practices referenced as evidence justifying the rating of a process attribute.

Each practice is linked to its parent entity, whether a process or a process attribute, through a numbering scheme, based upon the identifiers for processes and process attributes in the reference model.

Each practice is assigned an identifier consisting of a multi-part alphanumeric code.

For a base practice, the identifier is of the form: PC.PR.BPPN.

For a management practice, the identifier is of the form: MPCL.PA.PN.

Where the codes are:

- PC process category identifier
- PR process number (within the process category)
- BP the text “BP” used to signify Base Practice
- MP the text “MP” used to signify Management Practice
- CL capability level number
- PA process attribute number (within the capability level)

— PN practice number (within the process or process attribute)

For example, “ENG.1.3.BP1” denotes the base practice number 1 (Develop software architectural design) in the process category ENG (Engineering) for the process number 1.3 (Develop software design).

Similarly, “MP 2.2.1” denotes the management practice number 1 (Identify requirements) for the process attribute number 2 (Work product management attribute), capability level number 2 (Managed process).

Templates for constructing definition of new base practices and management practices are given in Annex D and Annex E respectively.

#### 4.7.2 Work product identification

Each work product is assigned a sequential number based upon the listing in the table of work product characteristics in Annex C. Several work products listed are of a generic type [e.g. “Requirement specification (52)”. Where a specific instantiation of this generic type is included as an indicator, this is shown by the use of *italics* to indicate the specific reference [e.g. “*Software* requirement specification (52)”. Annex C gives a complete definition of the work product nomenclature.

## 5 The process dimension

This clause defines the process dimension of the assessment model. The process dimension is directly mapped to that of the reference model, and adopts the same process definitions and structure given by the reference model.

The three life cycle process groupings are:

- The **Primary life cycle processes** consisting of the process categories Engineering and Customer-Supplier.
- The **Supporting life cycle processes** consisting of the process category Support.
- The **Organizational life cycle processes** consisting of the process categories Management and Organization.

The process dimension contains five process categories which are:

|     |                     |     |              |
|-----|---------------------|-----|--------------|
| CUS | Customer – Supplier | MAN | Management   |
| ENG | Engineering         | ORG | Organization |
| SUP | Support             |     |              |

The description of each process category includes a characterisation of the processes it contains, followed by a list of the process names.

The individual processes are described in terms of six components as defined in ISO/IEC TR 15504-2: Process Identifier, Process Name, Process Type, Process Purpose, Process Outcomes and Process Notes.

In addition the process dimension of the assessment model provides information in the form of

- a) a set of base practices for the process providing a definition of the tasks and activities needed to accomplish the process purpose and fulfil the process outcomes;
- b) a number of input and output work products associated with each process;
- c) characteristics associated with each work product.

The process purposes, outcomes and base practices are included in this clause. The work products associated with the processes and work product characteristics are contained in Annex A and Annex C respectively. The base practices, work products and work product characteristics constitute the set of indicators of process performance.

The process categories, processes and process type included in the process dimension of the assessment model are listed in Table 2.

Table 2 — Processes and process categories

| Process Category                |                                    | Process                                             |                             |
|---------------------------------|------------------------------------|-----------------------------------------------------|-----------------------------|
| ID                              | Title                              | ID                                                  | Title and (Type of process) |
| Primary Life Cycle processes    |                                    |                                                     |                             |
| CUS                             | Customer Supplier process category |                                                     |                             |
|                                 | CUS.1                              | Acquisition (basic)                                 |                             |
|                                 | CUS.1.1                            | Acquisition preparation (component)                 |                             |
|                                 | CUS.1.2                            | Supplier selection (component)                      |                             |
|                                 | CUS.1.3                            | Supplier Monitoring (component)                     |                             |
|                                 | CUS.1.4                            | Customer Acceptance (component)                     |                             |
|                                 | CUS.2                              | Supply (basic)                                      |                             |
|                                 | CUS.3                              | Requirements Elicitation (new)                      |                             |
|                                 | CUS.4                              | Operation (extended)                                |                             |
|                                 | CUS.4.1                            | Operational use (extended component)                |                             |
|                                 | CUS.4.2                            | Customer support (extended component)               |                             |
| ENG                             | Engineering process category       |                                                     |                             |
|                                 | ENG.1                              | Development (basic)                                 |                             |
|                                 | ENG.1.1                            | System requirements analysis and design (component) |                             |
|                                 | ENG.1.2                            | Software requirements analysis (component)          |                             |
|                                 | ENG.1.3                            | Software design (component)                         |                             |
|                                 | ENG.1.4                            | Software construction (component)                   |                             |
|                                 | ENG.1.5                            | Software integration (component)                    |                             |
|                                 | ENG.1.6                            | Software testing (component)                        |                             |
|                                 | ENG.1.7                            | System integration and testing (component)          |                             |
|                                 | ENG.2                              | System and software maintenance (basic)             |                             |
| Supporting Life Cycle processes |                                    |                                                     |                             |
| SUP                             | Support process category           |                                                     |                             |
|                                 | SUP.1                              | Documentation (extended)                            |                             |
|                                 | SUP.2                              | Configuration management (basic)                    |                             |
|                                 | SUP.3                              | Quality assurance (basic)                           |                             |
|                                 | SUP.4                              | Verification (basic)                                |                             |
|                                 | SUP.5                              | Validation (basic)                                  |                             |
|                                 | SUP.6                              | Joint review (basic)                                |                             |
|                                 | SUP.7                              | Audit (basic)                                       |                             |
|                                 | SUP.8                              | Problem resolution (basic)                          |                             |

Table 2 — Processes and process categories

| Process Category                    |                               | Process                              |                                   |
|-------------------------------------|-------------------------------|--------------------------------------|-----------------------------------|
| ID                                  | Title                         | ID                                   | Title and (Type of process)       |
| Organizational Life Cycle processes |                               |                                      |                                   |
| MAN                                 | Management process category   |                                      |                                   |
|                                     | MAN.1                         | Management (basic)                   |                                   |
|                                     | MAN.2                         | Project management (new)             |                                   |
|                                     | MAN.3                         | Quality Management (new)             |                                   |
|                                     | MAN.4                         | Risk Management (new)                |                                   |
| ORG                                 | Organization process category |                                      |                                   |
|                                     | ORG.1                         | Organizational alignment (new)       |                                   |
|                                     | ORG.2                         | Improvement process (basic)          |                                   |
|                                     |                               | ORG.2.1                              | Process establishment (component) |
|                                     |                               | ORG.2.2                              | Process assessment (component)    |
|                                     |                               | ORG.2.3                              | Process improvement (component)   |
|                                     | ORG.3                         | Human resource management (extended) |                                   |
|                                     | ORG.4                         | Infrastructure (basic)               |                                   |
|                                     | ORG.5                         | Measurement (New)                    |                                   |
|                                     | ORG.6                         | Reuse (New)                          |                                   |

### 5.1 Primary life cycle processes

The **Primary life cycle processes** consists of two process categories:

**CUS** Customer-Supplier

**ENG** Engineering

#### 5.1.1 Customer-Supplier Process Category (CUS)

The *Customer-Supplier* process category consists of processes that directly impact the customer, support development and transition of the software to the customer, and provide for the correct operation and use of the software product and/or service.

The processes belonging to the Customer-Supplier process category are:

- CUS.1** Acquisition Process
  - CUS.1.1** Acquisition Preparation Process
  - CUS.1.2** Supplier Selection Process
  - CUS.1.3** Supplier Monitoring Process
  - CUS.1.4** Customer Acceptance Process
- CUS.2** Supply Process
- CUS.3** Requirements Elicitation Process
- CUS.4** Operation Process
  - CUS.4.1** Operational Use Process
  - CUS.4.2** Customer Support Process

NOTE The “customer” can be external to the assessed organisation or internal, in which no contract is involved (e.g. development of software to meet a potential need elicited by market research, or in response to internally developed requirements for a potential customer.).

#### 5.1.1.1 CUS.1 Acquisition process

##### *Basic process*

The purpose of the *Acquisition process* is to obtain the product and/or service that satisfies the need expressed by the customer. The process begins with the identification of a customer need and ends with the acceptance of the product and/or service needed by the customer. As a result of successful implementation of the process:

- acquisition needs, goals, acceptance criteria and acquisition strategies will be defined;
- a contract will be developed that clearly expresses the expectation, responsibilities and liabilities of both the customer and the supplier;
- a product and/or service will be produced that satisfies the customer's stated need;
- the acquisition will be monitored so that specified constraints such as cost, schedule and quality are met;
- supplier deliverables will be accepted.

##### **Base Practices:**

**CUS.1.BP1: Identify the need.** Identify a need to acquire, develop, or enhance a system, software product, or software service.

**CUS.1.BP2: Prepare and negotiate contract.** Negotiate a contract with the supplier that clearly expresses the expectation, responsibilities, and liabilities of both the customer and the supplier.

**CUS.1.BP3: Monitor the acquisition.** Monitor the acquisition against the agreed acquisition documentation so that progress can be reviewed and audited to ensure that specified constraints such as cost, schedule, and quality are met.

#### 5.1.1.2 CUS.1.1 Acquisition preparation process

##### *Component process of CUS.1 — Acquisition process*

The purpose of the *Acquisition preparation process* is to establish the needs and goals of the acquisition. As a result of successful implementation of the process:

- the concept or the need to acquire, develop, or enhance a system, software product, or software process will be established;
- the customer's software and/or system requirements will be produced;
- an acquisition strategy will be developed;
- acceptance criteria will be defined.

##### **Base Practices:**

**CUS.1.1.BP1: Identify the need.** Identify a need to acquire, develop, or enhance a system, software product or software service.

**CUS.1.1.BP2: Define the requirements.** Identify the requirements for a system and/or software product that will satisfy the need for a new product and/or service.

**CUS.1.1.BP3: Prepare acquisition strategy.** Prepare a strategy for the acquisition of the product.

**CUS.1.1.BP4: Define acceptance criteria.** Establish and agree acceptance criteria and the means of evaluation to be used.

#### 5.1.1.3 CUS.1.2 Supplier selection process

##### *Component process of CUS.1 — Acquisition process*

The purpose of the *Supplier selection process* is to choose the organization that will be responsible for the implementation of the project identified in CUS.1.1. As a result of successful implementation of the process:

- the acquisition requirements (e.g. request for proposal) will be produced;
- the supplier will be selected based upon the evaluation of the supplier's proposals;
- a contract will be established and negotiated between the customer and the supplier.

##### **Base Practices:**

**CUS.1.2.BP1: Define acquisition requirements.** Identify and document the acquisition requirements (e.g. request for proposal).

**CUS.1.2.BP2: Select a supplier.** Select a supplier based upon an evaluation of supplier proposals, capabilities and other factors that need to be considered.

**CUS.1.2.BP3: Prepare and negotiate contract.** Negotiate a contract with the supplier that clearly expresses the expectation, responsibilities, and liabilities of both the customer and the supplier.

#### 5.1.1.4 CUS.1.3 Supplier monitoring process

##### *Component process of CUS.1 — Acquisition process*

The purpose of the *Supplier monitoring process* is to monitor the supplier's activities during the development of the software product and/or service. As a result of successful implementation of the process:

- joint activities between the customer and the supplier will be performed as needed;
- information on technical progress will be exchanged regularly with the supplier;
- performance of the supplier will be monitored against the agreed requirements.

##### **Base Practices:**

**CUS.1.3.BP1: Provide supplier feedback.** Maintain communications with the customer, keeping it up to date with progress, costs, and risks to successful completion.

**CUS.1.3.BP2: Review development with supplier.** Review technical aspects of the development on a regular basis with the supplier. This may include joint meetings with the supplier or formal communication to review the status for their requirements and requests.

NOTE Refer to the process *SUP.6 Joint review*.

**CUS.1.3.BP3: Monitor the acquisition.** Monitor the acquisition against the agreed acquisition documentation so that progress can be reviewed and audited to ensure that specified constraints such as cost, schedule, and quality are met.

**CUS.1.3.BP4: Monitor supplier.** Monitor the supplier against the agreed requirements.

#### 5.1.1.5 CUS.1.4 Customer acceptance process

##### *Component process of CUS.1 — Acquisition process*

The purpose of the *Customer acceptance process* is to approve the supplier's deliverable when all acceptance conditions are satisfied. As a result of successful implementation of the process:

- acceptance will be based on the acquisition strategy and conducted according to the agreed acceptance criteria;
- the delivered software product and/or service will be evaluated with regard to the agreed requirements.

##### **Base Practices:**

**CUS.1.4.BP1: Evaluate the delivered product.** Carry out the evaluation of the product or service against the agreed requirements.

**CUS.1.4.BP2: Accept the delivered product.** Accept the product or service when all the acceptance conditions have been satisfied.

#### 5.1.1.6 CUS.2 Supply process

##### *Basic process*

The purpose of the *Supply process* is to provide software to the customer that meets the agreed requirements. As a result of successful implementation of the process:

- response to customer's request will be produced;
- a contract will be established between the customer and the supplier for developing, packaging, delivering, and installing the software product and/or service;
- a software product and/or service that meets the agreed requirements will be developed by the supplier;
- the software product and/or service will be delivered to the customer and installed in accordance with the agreed requirements.

##### **Base Practices:**

**CUS.2.BP1: Prepare response.** Produce a proposal in response to the customer's request for proposal.

**CUS.2.BP2: Negotiate contract.** Establish a contract with the customer to provide the software product or service and review the contents of the contract before finalisation.

**CUS.2.BP3: Develop system or software.** Develop the system or software defined in the contract to meet the customer's requirements.

**CUS.2.BP4: Identify attributes for successful delivery and installation.** Using the acceptance criteria and the software requirements, define a set of attributes that will result in the successful delivery and installation of the software.

**CUS.2.BP5: Deliver and install software.** Supply the product in a manner acceptable to the customer, according to the identified attributes.

#### 5.1.1.7 CUS.3 Requirements elicitation process

##### *New process*

The purpose of the *Requirements elicitation process* is to gather, process, and track evolving customer needs and requirements throughout the life of the software product and/or service so as to establish a requirements baseline that serves as the basis for defining the needed software work products. As a result of successful implementation of the process:

- continuing communication with the customer will be established;
- agreed customer requirements will be defined;
- a mechanism will be established to incorporate new customer requirements into the established requirements baseline;
- a mechanism will be established for continuous monitoring of customer needs;
- a mechanism will be established for ensuring that customers can easily determine the status and disposition of their requests;
- enhancements arising from changing technology and customer needs will be identified and their impact managed.

##### **Base Practices:**

**CUS.3.BP1: Obtain customer requirements and requests.** Obtain and define customer requirements and requests through direct solicitation of customer and user input and through review of customer business proposals, target operating and hardware environment, and other documents bearing on customer requirements.

**CUS.3.BP2: Agree on requirements.** Obtain agreement across teams on the customer's requirements, obtaining the appropriate sign-offs by representatives of all teams and other parties contractually bound to work to these requirements.

**CUS.3.BP3: Establish customer requirements baseline.** Document the customer's requirements and establish as a baseline for project use and monitoring against customer needs.

**CUS.3.BP4: Manage customer requirements changes.** Manage all changes made to the customer requirements against the customer requirements baseline to ensure enhancements resulting from changing technology and customer needs are identified and that those who are affected by the changes are able to assess the impact and risks and initiate appropriate change control and mitigation actions.

NOTE The tracking of requirements is handled in *SUP.2 Configuration management process*.

**CUS.3.BP5: Understand customer expectations.** Review with customers and users their requirements and requests to better understand their needs and expectations.

**CUS.3.BP6: Establish customer query mechanism.** Provide a means by which the customer can be aware of the status and disposition of their requirements changes.

NOTE This may include joint meetings with the customer or formal communication to review the status for their requirements and requests; refer to the process *SUP.6 Joint review*.

#### 5.1.1.8 CUS.4 Operation process

##### *Extended process*

The purpose of the *Operation process* is to operate the software product in its intended environment and to provide support to the customers of the software product. As a result of successful implementation of the process:

- correct operation of the software in its intended environment will be evaluated;

- the software will be operated in its intended environment;
- assistance and consultation will be provided to the customers of the software product.

**Base Practices:**

**CUS.4.BP1: Software Operation.** Operate the software in its intended environment.

**CUS.4.BP2: Operation evaluation.** Evaluate the correct operation of the software.

**CUS.4.BP3: Support customer.** Provide assistance and consultation to the customer for operation of the software.

**5.1.1.9 CUS.4.1 Operational use process**

*Extended component process of CUS.4 — Operation process*

The purpose of the *Operational use process* is to ensure the correct and efficient operation of the software product for the duration of its intended usage and in its installed environment. As a result of successful implementation of the process:

- operational risks for the software introduction and operation will be identified and monitored;
- the software will be operated in its intended environment according to requirements;
- assurance will be provided that software capacities are adequate to meet customer needs.

**Base Practices:**

**CUS.4.1.BP1: Identify operational risks.** Identify and mitigate risks to system operation and functionality.

**CUS.4.1.BP2: Perform operational testing.** Perform operational testing of each release of the software, assessing satisfaction against specified criteria.

**CUS.4.1.BP3: Operate the software.** Operate the software in its intended environment and in the specified way.

**CUS.4.1.BP4: Review software operation problem.** Review priorities for problem resolution with the customer.

**CUS.4.1.BP5: Resolve operational problems.** Identify, record, and resolve problems arising from operation of the software (i.e. problems encountered by any individual interacting with the software).

NOTE The elimination of the cause of the operational problem will be handled by *SUP.8 Problem resolution process*.

**CUS.4.1.BP6: Handle user requests.** Monitor, record, and respond to all user requests and problems relating to the software, forwarding as appropriate to the maintenance function.

NOTE The implementation of approved requests will be achieved through *ENG.2 System and software maintenance process*.

**CUS.4.1.BP7: Document temporary work-arounds.** Provide documented temporary work-arounds as appropriate to maintain operation of the system until a permanent solution to a problem can be found.

NOTE The customer should be informed of the status and availability of the permanent solution.

**CUS.4.1.BP8: Monitor system capacity and service.** Provide the capability to monitor system capacity and operational service on a regular basis, where appropriate.

**5.1.1.10 CUS.4.2 Customer support process**

*Extended component process of CUS.4 — Operation process*

The purpose of the *Customer support process* is to establish and maintain an acceptable level of service to the customer to support effective use of the software product. Assistance and consultation to the customer is provided as requested to support the operation of the software product. As a result of successful implementation of the process:

- customer support service needs will be identified and monitored on an ongoing basis;
- customer satisfaction with both the support services being provided and the product itself will be evaluated on an ongoing basis;
- operational support will be provided by resolving operational problems and handling customer inquiries and requests;
- customer needs will be met through delivery of appropriate services.

**Base Practices:**

**CUS.4.2.BP1: Provide user training.** Provide training and documentation, as appropriate, to the user so that the software can be effectively used.

**CUS.4.2.BP2: Establish product support.** Establish a service by which the customer can raise problems and questions encountered in use of the software and receive help in resolving them.

NOTE The handling of problems will be handled in SUP.8 *Problem resolution process*.

**CUS.4.2.BP3: Monitor performance.** Monitor the operational performance of the software in order to be aware of problems which might impact level of service.

**CUS.4.2.BP4: Determine customer satisfaction level.** Determine the level of customer satisfaction with the software products and services received.

NOTE This may involve, as appropriate, field performance data, surveys, interviews, and studies. In some instances the end-user of the software may be different from the customer of the software. In this case, both the customer and end-user satisfaction levels should be determined.

**CUS.4.2.BP5: Compare with competitors.** Compare and monitor the level of customer satisfaction obtained for the software and services received relative to that of competitors.

NOTE It may be necessary to obtain information on competitors from third party sources. It may also be necessary to include information on how competitors define:

- customer satisfaction;
- measurement techniques;
- criteria;
- collection and evaluation methods;

to provide a meaningful comparison.

Where comparative data is not available, absolute targets (e.g. % customers very satisfied, % repeat business) may be used as a basis for planning.

**CUS.4.2.BP6: Communicate customer satisfaction.** Communicate customer satisfaction data throughout the supplier organization, in a manner appropriate to the staff involved and the nature of the findings.

### 5.1.2 Engineering process category (ENG)

The *Engineering process category* consists of processes that directly specify, implement or maintain the software product, its relation to the system and its customer documentation. In circumstances where the system is composed totally of software, the Engineering processes deal only with the construction and maintenance of such software.

The processes belonging to the Engineering process category are:

|         |                                                 |
|---------|-------------------------------------------------|
| ENG.1   | Development process                             |
| ENG.1.1 | System requirements analysis and design process |
| ENG.1.2 | Software requirements analysis process          |
| ENG.1.3 | Software design process                         |
| ENG.1.4 | Software construction process                   |
| ENG.1.5 | Software integration process                    |
| ENG.1.6 | Software testing process                        |
| ENG.1.7 | System integration and testing process          |
| ENG.2   | System and software maintenance process         |

#### 5.1.2.1 ENG.1 Development process

##### *Basic process*

The purpose of the *Development process* is to transform a set of requirements into a functional software product or software-based system that meets the customer's stated needs. As a result of successful implementation of the process:

- a software product or software-based system will be developed;
- intermediate work products will be developed that demonstrate that the end product is based upon the requirements;
- consistency will be established between requirements and designs;
- evidence (for example, testing evidence) will be provided that demonstrates that the end product meets the requirements;
- the end product will be installed in the target operating environment and accepted by the customer.

NOTE The requirements may be provided by operation of the *Acquisition process*, (CUS.1) or the *Requirements elicitation process* (CUS.3).

#### Base Practices:

**ENG.1.BP1: Define and implement the software or system development process.** Use the scope and scale of the software product or system to be developed as the basis for defining the activities and tasks that will be required to develop the product or system in an effective, efficient, economic manner.

**ENG.1.BP2: Define and implement the traceability process.** Use the activities in the development process to define the intermediate work products and methods for tracing requirements through those work products to the software product or system that is accepted by the customers.

**ENG.1.BP3: Define and implement the testing process.** Use the customer requirements and intermediate work product definitions to define the scope, scale and methods of testing that are necessary to demonstrate that the software product or system that is delivered to the customer meets its design criteria and the customer requirements.

**ENG.1.BP4: Define and implement the delivery process.** Use the customer requirements and knowledge of the target environment to define the activities that promote the software product or system from the development environment to the customer's target environment. Consideration should be given to schedules, resources and method of delivery, especially in the case of transition from an existing software product or system to the new one.

#### 5.1.2.2 ENG.1.1 System requirements analysis and design process

##### *Component process of ENG.1 — Development process*

The purpose of the *System requirements analysis and design process* is to establish the system requirements (functional and non-functional) and architecture, identifying which system requirements should be allocated to which elements of the system and to which releases. As a result of successful implementation of the process:

- requirements of the system will be developed that match the customer's stated needs;
- a solution will be proposed that identifies the main elements of the system;
- the requirements will be allocated to each of the main elements of the system;
- a release strategy will be developed that defines the priority for implementing system requirements;
- the system requirements will be approved and updated as needed;
- the requirements, proposed solution, and their relationships will be communicated to all affected parties.

#### Base Practices:

**ENG.1.1.BP1: Identify system requirements.** Use the customer requirements as the basis for defining the required functions and capabilities of the system and document in a system requirements specification.

**ENG.1.1.BP2: Analyze system requirements.** Analyze the prioritized requirements, identifying the necessary elements of the system and the interfaces between them.

**ENG.1.1.BP3: Describe system architecture.** Establish the top-level system architecture.

**ENG.1.1.BP4: Allocate requirements.** Allocate all system requirements to the elements of the top-level system architecture.

NOTE The result of performing base practices ENG.1.1.BP1 to ENG.1.1.BP4 is a documented product configuration which describes the position of each element in the system architecture and the requirements which it must address.

**ENG.1.1.BP5: Develop release strategy.** Map prioritized system requirements to future releases of the system.

**ENG.1.1.BP6: Communicate system requirements.** Establish communication mechanisms for dissemination of system requirements, and updates to requirements to all parties who will be using them.

**ENG.1.1.BP7: Establish traceability.** Establish traceability between the customer needs and the system requirements.

### 5.1.2.3 *ENG.1.2 Software requirements analysis process*

#### *Component process of ENG.1 — Development process*

The purpose of the *Software requirements analysis process* is to establish the requirements of the software components of the system. As a result of successful implementation of the process:

- the requirements allocated to software components of the system and their interfaces will be defined to match the customer's stated needs;
- analyzed, correct, and testable software requirements will be developed;
- the impact of software requirements on the operating environment will be understood;
- a software release strategy will be developed that defines the priority for implementing software requirements;
- the software requirements will be approved and updated as needed;
- consistency, will be established between system requirements and design and software requirements;
- the software requirements will be communicated to all affected parties.

#### **Base Practices**

**ENG.1.2.BP1: Specify software requirements.** Determine and analyze requirements of the software components of the system and document in a software requirements specification.

**ENG.1.2.BP2: Determine operating environment impact.** Determine the interfaces between the software requirements and other components of the operating environment, and the impact that the requirements will have.

NOTE The operating environment includes tasks performed by, or other systems used by, the intended users of the software product.

**ENG.1.2.BP3: Evaluate and validate requirements with customer.** Communicate the software requirements to the customer, and based on what is learned through this communication, revise if necessary.

**ENG.1.2.BP4: Develop validation criteria for software.** Use the software requirements to define the validation criteria for the software. The validation criteria are used in developing the software tests.

**ENG.1.2.BP5: Develop release strategy.** Prioritize the software requirements and map them to future releases of the software.

**ENG.1.2.BP6: Update requirements.** After completing an iteration of requirements, design, code, and test, use the feedback obtained from operation to modify the requirements for the next iteration.

**ENG.1.2.BP7: Communicate software requirements.** Establish communication mechanisms for dissemination of software requirements, and updates to requirements to all parties who will be using them.

**ENG.1.2.BP8: Evaluate the software requirements.** Evaluate the consistency and establish traceability between software requirements and system requirements.

### 5.1.2.4 *ENG.1.3 Software design process*

#### *Component process of ENG.1 — Development process*

The purpose of the *Software design process* is to define a design for the software that implements the requirements and can be tested against them. As a result of successful implementation of the process:

- an architectural design will be developed that describes the major software components that will implement the software requirements;
- internal and external interfaces of each software component will be defined;
- a detailed design will be developed that describes software units that can be built and tested;
- consistency will be established between software requirements and software designs.

#### **Base Practices:**

**ENG.1.3.BP1: Develop software architectural design.** Transform the software requirements into a software architecture that describes the top-level structure and identifies its major components.

**ENG.1.3.BP2: Design interfaces.** Develop and document a design for the external and internal interfaces.

**ENG.1.4.BP3: Verify the software design.** Verify that the software design satisfies related software requirements.

**ENG.1.3.BP4: Develop detailed design.** Decompose the top level design into a detailed design for each software component. The software components are refined into lower levels containing software units. The result of this base practice is a documented software design document which describes the position of each software unit in the software architecture.

NOTE The detailed design includes the specification of interfaces between the software units.

**ENG.1.3.BP5: Establish Traceability.** Establish traceability between the software requirements and the software design.

#### 5.1.2.5 *ENG.1.4 Software construction process*

##### *Component process of ENG.1 — Development process*

The purpose of the *Software construction process* is to produce executable software units and to verify that they properly reflect the software design. As a result of successful implementation of the process:

- verification criteria will be defined for all software units against their requirements;
- software units defined by the design will be produced;
- consistency will be established between software requirements and design and software components;
- verification of the software units against the design will be accomplished.

NOTE Part of this process is similar to the process *Verification process* (SUP.4).

#### **Base Practices:**

**ENG.1.4.BP1: Develop software units.** Develop and document each software unit.

NOTE This base practice involves creating and documenting, the final representations of each software unit.

**ENG.1.4.BP2: Develop unit verification procedures.** Develop and document procedures for verifying that each software unit satisfies its design requirements.

NOTE The normal verification procedure will be through unit testing, and the verification procedure will include unit test cases and unit test data.

**ENG.1.4.BP3: Verify the software units.** Verify that each software unit satisfies its design requirements and document the results.

**ENG.1.4.BP4: Establish traceability.** Establish traceability between the software design and the software units and ensure consistency with software requirements.

#### 5.1.2.6 *ENG.1.5 Software integration process*

##### *Component process of ENG.1 — Development process*

The purpose of the *Software integration process* is to combine the software units, producing integrated software items and to verify that the integrated software units properly reflect the software design. As a result of successful implementation of the process:

- an integration strategy will be developed for software units consistent with the release strategy;
- verification criteria for software items will be developed that ensure compliance with the software requirements allocated to the items;
- software items defined by the integration strategy will be produced;
- software items will be verified using the defined acceptance criteria;
- results of integration testing will be recorded;
- consistency will be established between software requirements and software items;
- a regression strategy will be developed for reverifying software items should a change in software units occur;
- regression testing will be carried out as necessary.

NOTE Part of this process is similar to the process *Verification process* (SUP.4).

#### **Base Practices:**

**ENG.1.5.BP1: Develop software integration strategy.** Develop the strategy for integrating software units consistent with the release strategy. Identify aggregates of software units and a sequence or order for testing them.

NOTE Typically, the software architecture and the release strategy will have some influence on the selection of aggregates.

**ENG.1.5.BP2: Develop integrated software item regression test strategy.** Develop the strategy for retesting integrated software items should a change in a given software unit be made.

**ENG.1.5.BP3: Develop tests for integrated software items.** Describe the tests to be run against each integrated software item, indicating software requirements being checked, input data and verification criteria.

**ENG.1.5.BP4: Test integrated software items.** Test each integrated software item against the verification criteria, and document the results.

**ENG.1.5.BP5: Integrate software item.** Integrate the aggregated software items to form a complete software system. Ensure consistency between software requirements and software designs.

**ENG.1.5.BP6: Regression test integrated software items.** If changes are made to software units carry out regression testing as defined in the regression test strategy.

#### 5.1.2.7 *ENG.1.6 Software testing process*

##### *Component process of ENG.1 — Development process*

The purpose of the *Software testing process* is to test the integrated software producing a product that will satisfy the software requirements. As a result of successful implementation of the process:

- acceptance criteria for integrated software will be developed that verify compliance with the software requirements;
- integrated software will be verified using the defined acceptance criteria;
- test results will be recorded;
- a regression strategy will be developed for retesting the integrated software should a change in software items be made;
- regression testing will be carried out as necessary.

#### **Base Practices:**

**ENG.1.6.BP1: Develop integrated software test strategy, including regression strategy.** Develop the strategy for testing the software, and for retesting aggregates should a change in a given software item be made.

**ENG.1.6.BP2: Develop tests for integrated software.** Describe the tests to be run against the complete software product, indicating software requirements being checked, input data, and verification criteria. The set of tests should demonstrate compliance with the software requirements.

NOTE Tests can be developed during process, ENG.1.2, *Software requirements analysis process*, ENG.1.3, *Software design process* and ENG.1.4, *Software construction process*. Commencement of test development should generally not wait until software integration.

**ENG.1.6.BP3: Test integrated software.** Test the integrated software against the verification criteria, and document the results.

**ENG.1.6.BP4: Regression test integrated software.** If changes are made to software items carry out regression testing as defined in the regression test strategy.

#### 5.1.2.8 *ENG.1.7 System integration and testing process*

##### *Component process of ENG.1 — Development process*

The purpose of the *System integration and testing process* is to integrate the software component with other components, such as manual operations or hardware, producing a complete system that will satisfy the customers' expectations expressed in the system requirements. The resources allocated to system integration should include someone familiar with the software component. As a result of successful implementation of the process:

- an integration strategy will be developed to build system unit aggregates according to the release strategy;
- acceptance criteria for each aggregate will be developed to verify compliance with the system requirements allocated to the units;
- system aggregates will be verified using the defined acceptance criteria;
- an integrated system demonstrating compliance with the system requirements (functional, non-functional, operations and maintenance) and validation that a complete set of useable deliverable components exists, will be constructed;
- test results will be recorded;
- a regression strategy will be developed for retesting aggregates or the integrated system should a change be made to existing components;

— regression testing will be carried out as necessary.

NOTE Part of this process is similar to the processes *Verification Process* (SUP.4) and *Validation process* (SUP.5).

#### Base Practices:

**ENG.1.7.BP1: Develop system integration and test strategy.** Develop the strategy for integrating system units consistent with the release strategy and for testing the system.

**ENG.1.7.BP2: Develop system regression test strategy.** Develop the strategy for retesting aggregates should a change in a given system item be made.

**ENG.1.7.BP3: Build aggregates of system units.** Identify aggregates of system units and a sequence or order for testing them.

NOTE Typically, the system architecture and the release strategy will have some influence on the selection of aggregates.

**ENG.1.7.BP4: Develop tests for system aggregates.** Describe the tests to be run against each system aggregate, indicating requirements being checked, input data, system components needed to perform the test, and validation criteria.

**ENG.1.7.BP5: Test system aggregates.** Test each system aggregate and ensure that it satisfies its requirements, and document the results.

**ENG.1.7.BP6: Develop tests for system.** Describe the tests to be run against the integrated system, indicating system requirements being checked, input data, and validation criteria.

NOTE 1 This can be performed during process ENG.1.1, *System requirements analysis and design process*.

NOTE 2 The set of tests should demonstrate compliance with the system requirements.

**ENG.1.7.BP7: Test integrated system.** Test the integrated system and ensure that it satisfies the system requirements, and document the results.

**ENG.1.7.BP8: Regression test system aggregates or integrated system.** If changes are made to system components carry out regression testing as defined in the regression test strategy.

#### 5.1.2.9 ENG.2 System and software maintenance process

##### Basic process

The purpose of the *System and software maintenance process* is to manage modification, migration and retirement of system components (such as hardware, software, manual operations and network if any) in response to customer requests. The origin of requests might be a discovered problem or the need for improvement or adaptation. The objective is to modify and/or retire existing systems and/or software while preserving the integrity of organizational operations. As a result of successful implementation of the process:

- a maintenance strategy will be developed to manage modification, migration and retirement of system components according to the release strategy;
- the impact of organization, operations and interfaces on the existing system in operation will be defined;
- specifications, design documents and test strategies will be updated;
- modified system components will be developed with associated tests that demonstrate that the system requirements will not be compromised;
- system and software upgrades will be migrated to the customer's environment;
- on request, software and systems will be retired from use in a controlled manner that minimizes disturbance to the customers.

NOTE 1 The initial defined requirements may be provided by the *Requirements elicitation process* (CUS.3).

NOTE 2 This process interacts closely with other processes such as *Operation process* (CUS.4), *Customer support process* (CUS.4.2), and *Problem resolution process* (SUP.8).

#### Base Practices:

**ENG.2.BP1: Determine maintenance requirements.** Determine the system and software maintenance requirements, identifying the system and software elements to be maintained, and their required enhancements.

**ENG.2.BP2: Develop maintenance strategy.** Develop the strategy for managing modification, migration, and retirement of system components consistent with the maintenance requirements and the release strategy.

NOTE Some of the required enhancements may have been previously planned but deferred.

**ENG.2.BP3: Analyze user problems and enhancements.** Analyze user problems and requests and required enhancements, evaluating the possible impact of different options for modifying the operational system and software, system interfaces, and requirements.

NOTE This Base Practice links to the process SUP.8, *Problem resolution process*.

**ENG.2.BP4: Determine modifications for next upgrade.** Based on the above analyses, determine which modifications should be applied in the next system or software upgrade, documenting which software items, units and other system elements and which documentation will need to be changed and which tests will need to be run.

**ENG.2.BP5: Implement and test modifications.** Use the other engineering processes, as appropriate, to implement and test the selected modifications, demonstrating that the unmodified system and software requirements will not be compromised by the upgrade.

**ENG.2.BP6: Upgrade user system.** Migrate the upgraded system and software with applied modifications to the user's environment, providing for, as appropriate

- parallel operation of the previous and upgraded systems;
- additional user training;
- support options;
- retirement of the previous system.

**ENG.2.BP7: Retire user system.** Following approval, retire the obsolete system from the user environment, providing for, as appropriate

- parallel operation with replacement systems
- conversion of data to new or replacement systems
- archiving of system and data files
- user training for the conversion program.

## 5.2 Supporting life cycle processes

The **Supporting life cycle** processes consist of one process category:

### SUP      Support

#### 5.2.1 Support process category (SUP)

The *Support process category* consists of processes that may be employed by any of the other processes (including other supporting processes) at various points in the software life cycle.

The processes belonging to the Support process category are:

|       |                                  |
|-------|----------------------------------|
| SUP.1 | Documentation Process            |
| SUP.2 | Configuration Management Process |
| SUP.3 | Quality Assurance Process        |
| SUP.4 | Verification Process             |
| SUP.5 | Validation Process               |
| SUP.6 | Joint Review Process             |
| SUP.7 | Audit Process                    |
| SUP.8 | Problem Resolution Process       |

##### 5.2.1.1 SUP.1 Documentation process

###### *Extended process*

The purpose of the *Documentation process* is to develop and maintain documents that record information produced by a process or activity. As a result of successful implementation of the process:

- a strategy identifying the documents to be produced during the life cycle of the software product will be developed;
- the standards to be applied for the development of documents will be identified;
- all-documents to be produced by the process or project will be identified;

- the content and purpose of all documents will be specified, reviewed and approved;
- all documents will be developed and published in accordance with identified standards;
- all documents will be maintained in accordance with specified criteria.

NOTE The process supports performance of the process attribute 2.2 in those instances where it is invoked.

#### Base Practices:

**SUP.1.BP1: Develop documentation policy.** Determine documentation policy which addresses where, when and what should be documented during the life cycle of the software product/service.

**SUP.1.BP2: Establish standards for documents.** Establish standards for developing, modifying and maintaining documents.

**SUP.1.BP3: Specify documentation requirements.** Specify requirements for documents such as title, date, identifier, version history, author(s), reviewer, authorizer, outline of contents, purpose; distribution list.

**SUP.1.BP4: Develop document.** Develop documents at required process points according to established standards and policy.

**SUP.1.BP5: Check document.** Review documents before distribution, and authorize documents before distribution or release.

NOTE 1 In the case of user documentation, this is a particularly important base practice, because documentation intended for use by system and software users should accurately describe the system and software and how it is to be used in a manner which is clear and useful to the user.

NOTE 2 Documents should be checked through verification or validation process with stakeholders.

**SUP.1.BP6: Distribute document.** Distribute and confirm delivery of documents, where necessary, via appropriate media to specified audiences.

**SUP.1.BP7: Maintain document.** Maintain documents according to the defined procedures.

NOTE If the document is part of a product baseline or if its control and stability are important, it should be modified and distributed in accordance with process *SUP.2 Configuration management*. If the document is part of a product baseline under maintenance, its maintenance is covered by process *ENG.2 System and software maintenance*.

#### 5.2.1.2 SUP.2 Configuration management process

##### Basic process

The purpose of the *Configuration management process* is to establish and maintain the integrity of all the work products of a process or project. As a result of successful implementation of the process:

- a configuration management strategy will be developed;
- all items generated by the process or project will be identified, defined and baselined;
- modifications and releases of the items will be controlled;
- the status of the items and modification requests will be recorded and reported;
- the completeness and consistency of the items will be ensured;
- storage, handling and delivery of the items will be controlled.

NOTE The process supports performance of the process attribute 2.2 in those instances where it is invoked.

#### Base Practices:

**SUP.2.BP1: Develop configuration management strategy.** Determine configuration management strategy, including configuration management activities and schedule for performing these activities.

**SUP.2.BP2: Establish configuration management system.** Establish a configuration management system including libraries, standards, procedures and tools.

**SUP.2.BP3: Identify configuration items.** Identify configuration items, such as software system, modules, components and related documents by identifying the documentation that establishes the baseline; the version references and other relevant identification details.

**SUP.2.BP4: Maintain configuration item description.** Maintain a up-to-date description of each configuration item.

NOTE The description should identify:

- its decomposition into lower level configuration components;
- who is responsible for each item;
- when it is placed under configuration management.

**SUP.2.BP5: Manage changes.** Record and report status of configuration items and modification requests. Changes to any configuration items should be reviewed and authorized.

**SUP.2.BP6: Manage product releases.** Release and delivery of any configuration items should be reviewed and authorized.

**SUP.2.BP7: Maintain configuration item history.** Maintain a history of each configuration item in sufficient detail to recover a previously baselined versions when required.

**SUP.2.BP8: Report configuration status.** Regularly report status of each configuration item and their relationship in the current system integration.

**SUP.2.BP9: Manage the release and delivery of configuration items.** The storage, handling, release and delivery of the configuration items should be controlled.

#### 5.2.1.3 SUP.3 Quality assurance process

##### *Basic process*

The purpose of the *Quality assurance process* is to provide assurance that work products and processes of a process or project comply with their specified requirements and adhere to their established plans. As a result of successful implementation of the process:

- a strategy for conducting the quality assurance process activities and tasks will be developed, implemented and maintained;
- evidence of quality assurance activities and tasks will be produced and maintained;
- problems or non-conformances with contract requirements will be identified;
- adherence of software products, processes and activities to the applicable standards, procedures and requirements will be verified objectively.

NOTE 1 To be unbiased, quality assurance must have organizational freedom and authority from persons directly responsible for developing the software product or executing the process.

NOTE 2 Quality assurance should be coordinated with, and may make use of, the results of other supporting processes such as Verification, Validation, Joint reviews, Audits, and Problem resolution.

NOTE 3 Establishment of a quality management system in accordance with ISO 9001 will establish a capable quality assurance process.

NOTE 4 The process supports performance of the process attributes 2.1 and 2.2 in those instances where it is invoked.

##### **Base Practices:**

**SUP.3.BP1: Develop quality assurance strategy.** Develop, implement and maintain quality policy, scope of assurance and responsibilities for quality.

**SUP.3.BP2: Establish quality standards.** Establish quality standards for each process and work product.

**SUP.3.BP3: Define quality records.** Define quality records that demonstrate conformance of process and work products to quality standards.

**SUP.3.BP4: Assure quality of process activities.** Carry out a series of activities to provide the required level of confidence that the software processes have followed the specified standards.

**SUP.3.BP5: Assure quality of work products.** Carry out a series of activities to provide the required level of confidence that the work products meet the quality standards and requirements.

**SUP.3.BP6: Report quality results.** Report performances, deviations, and trends of the above activities to appropriate audience.

**SUP.3.BP7: Handle deviations.** Any deviations should be reported, analyzed, corrected and further prevented.

#### 5.2.1.4 SUP.4 Verification process

##### *Basic process*

The purpose of the *Verification process* is to confirm that each software work product and/or service of a process or project properly reflects the specified requirements. As a result of successful implementation of the process:

- a verification strategy will be developed and implemented;
- criteria for verification of all required software work products will be identified;
- required verification activities will be performed;

- identified defects will be found and removed from software work products;
- results of the verification activities will be made available to the customer and other involved organizations.

NOTE 1 The process supports performance of the process attribute 2.1 and 2.2 in those instances where it is invoked.

NOTE 2 The process normally involves the performance of testing of the work products to ensure that they fulfil their intended use.

NOTE 3 The process is closely linked with performance of the *Software testing process* (ENG.1.6) and *System integration and testing process* (ENG.1.7).

NOTE 4 ISO/IEC 12207 contains specific requirements for the content of the verification plan.

NOTE 5 ISO/IEC 12207 contains specific criteria for verification activities that are dependent on the object of the verification activity.

NOTE 6 The process may involve performance of techniques including peer reviews, formal proof and traceability analysis, among others.

#### Base Practices:

**SUP.4.BP1: Develop verification strategy.** Develop a verification strategy specifying the criteria for verification of all required work products.

**SUP.4.BP2: Conduct verification.** Verify identified work products according to specified strategy.

**SUP.4.BP3: Determine actions for verification results.** Analyze problems found in verification and determine action to solve the problems.

**SUP.4.BP4: Track actions for verification results.** Track status and results of actions for correcting problems identified in verification. The results should be made available to the customer and other involved organizations.

#### 5.2.1.5 SUP.5 Validation process

##### Basic process

The purpose of the *Validation process* is to confirm that the requirements for a specific intended use of the software work product are fulfilled. As a result of successful implementation of the process:

- a validation strategy will be developed and implemented;
- criteria for validation of all required work products will be identified;
- required validation activities will be performed;
- all identified problems will be resolved;
- evidence will be provided that the software work products as developed are suitable for their intended use;
- results of the validation activities will be made available to the customer and other involved organizations.

NOTE 1 This process is closely linked with performance of the *System integration and testing process* (ENG.1.7).

NOTE 2 The process normally involves the performance of testing of the work products to ensure that they fulfil their intended use.

#### Base Practices:

**SUP.5.BP1: Develop Validation Strategy.** Develop a validation strategy specifying the criteria for verification of all required work products.

**SUP.5.BP2: Perform validation.** Conduct validation using identified techniques, processes, and test cases against requirements and quality standards.

**SUP.5.BP3: Determine actions for validation results.** Analyze problems found in validation and determine action to the problems.

**SUP.5.BP4: Track actions for validation results.** Track status and results of actions for correcting problems identified in validation. The results should be made available to the customer and other involved organization.

#### 5.2.1.6 SUP.6 Joint review process

##### Basic process

The purpose of the *Joint review process* is to maintain a common understanding with the customer of the progress against the objectives of the contract and what should be done to help ensure development of a product that satisfies the customer. Joint reviews are at both project management and technical levels and are held throughout the life of the project. As a result of successful implementation of the process:

- periodic reviews will be held at predetermined milestones;

- the status and products of an activity of a process will be evaluated through joint review activities between the customers, suppliers and other stakeholders (or interested parties);
- review results will be made known to all affected parties;
- action items resulting from reviews will be tracked to closure.

NOTE 1 The process supports performance of the process attribute 2.1 in those instances where it is invoked.

NOTE 2 The process is most commonly invoked in circumstances where performance of a project is governed by a form of contract.

NOTE 3 ISO/IEC 12207 contains specific requirements for project management reviews and for technical reviews.

#### **Base Practices:**

**SUP.6.BP1: Prepare joint review.** For preparing a joint internal (inter-process) or external (developer/customer) review, the following items should be prepared:

- scope of review;
- topics for review;
- attendees;
- distribution list of affected parties;
- responsibilities of attendants;
- desired outputs;
- a schedule;
- resource and facility requirements.

**SUP.6.BP2: Establish review criteria.** Establish criteria for a joint review, such as for problem identification, resolution and agreement.

**SUP.6.BP3: Conduct joint management review.** Conduct periodic joint management reviews to evaluate and assess:

- proposal against requirements;
- achievement against project plan and schedule;
- risks;
- readiness to transfer to the next process.

**SUP.6.BP4: Conduct joint technical review.** Conduct periodic joint technical reviews to evaluate and assess technical issues and status against customer requirements and acceptance criteria documented in the contract.

**SUP.6.BP5: Conduct joint process review.** Conduct periodic joint process reviews to evaluate and assess suitability and capability of the current processes for a project.

**SUP.6.BP6: Conduct joint system acceptance review.** Conduct joint system acceptance review to demonstrate to the customer that the final system's completeness and correctness in configuration and functionality complies with appropriate standards and specifications, and satisfies the acceptance criteria documented in the contract.

**SUP.6.BP7: Determine actions for review results.** Analyze review report; distribute review report; propose resolution(s) for the review results; determine priority for actions.

**SUP.6.BP8: Track actions for review results.** Track actions for resolutions of identified problems in a review; report and document changes of work products and processes.

#### **5.2.1.7 SUP.7 Audit Process**

##### *Basic process*

The purpose of the *Audit process* is to independently determine compliance of selected products and processes with the requirements, plans and contract, as appropriate. As a result of successful implementation of the process:

- an audit strategy will be developed and implemented;
- audits will be held at predetermined milestones;
- compliance of selected software work products and/or services or processes with requirements, plans and contract will be determined according to the audit strategy;
- the conduct of audits by an appropriate independent party will be arranged;

— problems detected during an audit will be identified, communicated to those responsible for corrective action, and resolved.

NOTE 1 The process supports performance of the process attribute 2.1 in those instances where it is invoked.

NOTE 2 This process may be employed by any two parties, where one party (auditing party) audits the software products or activities of another party (audited party).

NOTE 3 ISO/IEC 12207 identifies specific software work products (and results of an activity) to be audited.

#### **Base Practices:**

**SUP.7.BP1: Develop and implement audit strategy.** Develop and implement audit strategy specifying the criteria for compliance with the requirements, plans, and contract as appropriate.

**SUP.7.BP2: Plan an audit.** For planning an audit, the following items should be prepared:

- scope of audit;
- topics for audit;
- attendees;
- responsibilities of attendants;
- entry and exit criteria for the audit;
- a schedule;
- resource requirement.

**SUP.7.BP3: Audit software development activities.** Conduct audits at predetermined milestones to ensure:

- contract meets organization's requirements;
- system specification meets customer's requirements;
- design conforms with specification;
- software products reflect the design documents;
- testing coverage meets quality assurance requirements;
- software product quality reached organization's standards;
- documentation complies with managerial and customer's requirements.

**SUP.7.BP4: Audit management activities.** Conduct audits at predetermined milestones on management activities to ensure:

- proposal against requirements;
- achievement against project plan and schedule;
- risks control;
- compliance with appropriate standards;

**SUP.7.BP5: Audit process performance.** Conduct audits at predetermined milestones on process performance to ensure the suitability and capability of the current processes for a project.

**SUP.7.BP6: Audit final products and system.** Audit the final system to ensure that completeness and correctness of configuration and functionality complies with appropriate standards and specifications, and satisfies the acceptance criteria documented in the contract.

**SUP.7.BP7: Identify corrective actions from the audit report.** Analyze audit report; distribute audit report; document proposed resolution(s) for audit results; determine priority for actions for resolutions.

**SUP.7.BP8: Track actions for audit report.** Track actions for resolutions of identified problems by audit; report and document changes of work products and processes.

#### **5.2.1.8 SUP.8 Problem resolution process**

##### *Basic process*

The purpose of the *Problem resolution process* is to ensure that all discovered problems are analyzed and resolved and that trends are recognized. As a result of successful implementation of the process:

- the problem resolution activities will be identified to ensure that all discovered problems are analyzed and resolved;
- problem reports will be prepared upon detection of problems (including non-conformances) in a software product or activity;

— a mechanism will be provided for recognizing and acting on trends in problems identified.

NOTE The process supports performance of the process attributes 2.1 and 2.2 in those instances where it is invoked.

#### Base Practices:

**SUP.8.BP1: Establish problem report system.** A problem report system should be established to ensure problems and divergences can be detected, described, recorded, analyzed, corrected and prevented in every process.

**SUP.8.BP2: Prioritize problems.** Prioritize problems according to the cause, range and severity level described in problem reports.

**SUP.8.BP3: Determine actions for problems.** Analyze problem causes; propose resolution(s); and determine priority for actions.

**SUP.8.BP4: Track actions for problems.** Track resolutions of identified problems; notify affected parties; report and document changes of work products and processes.

**SUP.8.BP5: Review and distribute solutions.** Distribute corrected component process or system after relevant review and authorization.

**SUP.8.BP6: Analyze problem trends.** Collect and analysis data on problem occurrence, detection, affected range, and correction actions at product, process, project and organization levels, in order to identify the trends of problems in practices and processes.

### 5.3 Organizational life cycle processes

The **Organizational life cycle** processes consist of two Process categories:

MAN      Management

ORG      Organization

#### 5.3.1 Management process category (MAN)

The *Management process category* consists of processes that contain practices of a generic nature that may be used by anyone who manages any type of project or process within a software life cycle.

The processes belonging to the Management process category are:

MAN.1      Management Process

MAN.2      Project Management Process

MAN.3      Quality Management

MAN.4      Risk Management

##### 5.3.1.1 MAN.1 Management process

###### *Basic process*

The purpose of the *Management process* is to organize, monitor, and control the initiation and performance of any processes or functions within the organization to achieve their goals and the business goals of the organization in an effective manner. As a result of successful implementation of the process:

- the activities and tasks that must be performed to achieve the purpose of the process or function will be identified;
- the feasibility of achieving process goals with available resources and constraints will be evaluated;
- the resources and infrastructure required to perform the identified activities and tasks will be established;
- activities will be identified and tasks will be implemented;
- performance of the defined activities and tasks will be monitored;
- work products resulting from the process activities will be reviewed and results analyzed and evaluated;
- action will be taken to modify the performance of the process or function when performance deviates from the identified activities and tasks or fails to achieve their goals;
- successful achievement of the purpose of the process or function will be demonstrated.

NOTE This process supports performance of the process attributes 2.1 and 2.2 in those instances where it is invoked.

**Base Practices:**

**MAN.1.BP1: Identify activities and tasks.** Identify the activities and tasks that have to be performed to achieve the purpose of the process or function and establish meaningful milestones.

**MAN.1.BP2: Evaluate feasibility of achieving process.** Evaluate the feasibility of achieving process with available resources and constraints.

**MAN.1.BP3: Plan and allocate resources and infrastructure.** Plan and allocate the resources and infrastructure required to perform the identified activities and tasks according to a defined time schedule.

**MAN.1.BP4: Implement activities.** Implement activities and tasks by assigning clear responsibilities to individuals.

**MAN.1.BP5: Monitor performance.** Regularly monitor performance of the defined activities and tasks with respect to achievement of the established milestones within the defined cost and time constraints.

**MAN.1.BP6: Review work products and evaluate results.** Review work products for completeness and quality; analyse and evaluate results.

**MAN.1.BP7: Take action on performance deviation.** Take appropriate action to modify performance of the process or function when performance deviates from what is expected; adjust and update plans accordingly.

**MAN.1.BP8: Demonstrate successful achievement.** Demonstrate successful achievement of the purpose of the process or function by using quantitative or qualitative evidence.

**5.3.1.2 MAN.2 Project management process***New process*

The purpose of the *Project management process* is to identify, establish, coordinate and monitor activities, tasks and resources necessary for a project to produce a product and/or service meeting the requirements. As a result of successful implementation of the process:

- the scope of the work for the project will be defined;
- the feasibility of achieving the goals of the project with available resources and constraints will be evaluated;
- the tasks and resources necessary to complete the work will be sized and estimated;
- interfaces between elements in the project, and with other projects and organizational units, will be identified and monitored;
- plans for execution of the project will be developed and implemented;
- progress of the project will be monitored and reported;
- actions to correct deviations from the plan and to prevent recurrence of problems identified in the project will be taken when project targets are not achieved.

NOTE This process supports performance of the process attribute 2.1 in those instances where it is invoked.

**Base Practices:**

**MAN.2.BP1: Define the scope of work.** Define the work to be undertaken by the project, and determine that achievement of the goals of the project is feasible with available resources and constraints.

NOTE For the identification of quality goals see MAN.3.BP1.

**MAN.2.BP2: Determine development strategy.** Evaluate options available for achieving the goals of the project, and determine, on the basis of risks and opportunities, which strategy will be adopted.

**MAN.2.BP3: Select software life cycle model.** Select a software life cycle model for the project which is appropriate to the scope, magnitude and complexity of the project.

NOTE This base practice is related to MAN.2.BP1.

**MAN.2.BP4: Size and estimate tasks and resources.** Size and estimate tasks and resources necessary to complete the work by evaluating the options available for achieving the goals of the project and by taking into consideration existing risks and opportunities.

NOTE 1 This implies for projects involving the development of software that a development strategy is determined, a software life cycle model which is appropriate to the scope, magnitude and complexity of the project is selected, and what is needed for the entire software life cycle to satisfy the software requirements is estimated.

NOTE 2 For the identification of existing risks see MAN.4.BP2.