PD ISO/IEC TS 33061:2021

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Information technology — Process assessment — Process assessment model for software life cycle processes

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National foreword

This Published Document is the UK implementation of ISO/IEC TS 33061:2021. It supersedes BS ISO/IEC 15504-5:2012, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee IST/15, Software and systems engineering.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEClist of patent declarations received (see http://patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

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

This document cancels and replaces ISO/IEC 15504-5:2012, which has been technically revised.

The main changes compared to ISO/IEC 15504-5:2012 are as follows:

— all processes and their base practices are changed to reflect the ISO/IEC/IEEE 12207 processes;

— all process related process outputs and their descriptions are revised;

— this process assessment model includes a process quality attribute of process performance and can be used with other models of process quality, for instance capability as described in ISO/IEC 33020.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

The set of International Standards ISO/IEC 33001 to ISO/IEC 33099, termed the ISO/IEC 330xx family, defines the requirements and resources needed for process assessment. The overall architecture and content of the ISO/IEC 330xx family is described in ISO/IEC 33001. Several standards in the ISO/IEC 330xx family for process assessment are intended to replace and extend parts of the ISO/IEC 15504 series. Abstracts and previews of the ISO/IEC 330xx family of standards can be found on the ISO website.

This document defines a process assessment model for software life cycle processes, conformant with the requirements of ISO/IEC 33004, for use in performing a conformant assessment in accordance with the requirements of ISO/IEC 33002.

A process assessment model is related to one or more process reference models. The process reference model defined in ISO/IEC/IEEE 12207 is used as the basis for the process assessment model in this document.

A process assessment model incorporates a process measurement framework conformant with the requirements of ISO/IEC 33003 and is expressed as a process quality characteristic with a defined set of process attributes.

A process assessment model includes a set of assessment indicators. Process performance indicators address the process purpose and outcomes of each process in the process assessment model. Process quality indicators demonstrate the achievement of the process attributes in the process measurement framework. These indicators may also provide a reference source of practices when implementing a process improvement program.

The assessment indicators are used as a basis for collecting objective evidence to support an assessor's judgement in assigning ratings of the performance and quality of an implemented process. The set of indicators defined in this document are not intended to be an all-inclusive set and applicable in its entirety. Subsets appropriate to the context and scope of the assessment should be selected, and potentially augmented with additional indicators.

A process assessment is conducted according to a documented assessment process. A documented assessment process identifies the rating method to be used in rating process attributes and identifies or defines the aggregation method to be used in determining ratings.

ISO/IEC 33020 provides a process measurement framework for the assessment of process capability which may be incorporated as a process measurement framework in this document. ISO/IEC 33020:2019, Annex B includes a set of process quality indicators for each process attribute in the process measurement framework.

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Information technology — Process assessment — Process assessment model for software life cycle processes

1 Scope

This document defines a process assessment model for software life cycle processes, conformant with the requirements of ISO/IEC 33004, for use in performing a conformant assessment in accordance with the requirements of ISO/IEC 33002.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC/IEEE 12207:2017, *Systems and software engineering — Software life cycle processes*

ISO/IEC 33001, *Information technology — Process assessment — Concepts and terminology*

ISO/IEC 33003:2015, *Information technology — Process assessment — Requirements for process measurement frameworks*

ISO/IEC 33004:2015, *Information technology — Process assessment — Requirements for process reference, process assessment and maturity models*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 33001 apply.

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

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

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

4 The process assessment model

4.1 General

This document provides a basis for a process assessment model that is two-dimensional. In one dimension, the process dimension, the processes are defined and classified into process groups together with the set of assessment indicators of process performance. In the other dimension, the quality dimension, for each process attribute in the process measurement framework a set of process quality indicators is defined for the selected process quality characteristic.

This document applies the software system concepts as defined in ISO/IEC/IEEE 12207. These concepts include software systems, software system architecture and enabling systems.

NOTE 1 The software systems considered in this document are human-made, created and utilized to provide products or services in defined environments for the benefit of users and other stakeholders. These software systems can include the following system elements: hardware, software, data, humans, processes (e.g. processes for providing service to users), procedures (e.g. operator instructions), facilities, services, materials and naturally occurring entities. As viewed by the user, they are thought of as products or services. (ISO/IEC/IEEE 12207)

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NOTE 2 This document applies to systems for which software is of primary importance to the stakeholders. It is based upon the general principles of systems engineering and software engineering. It is a fundamental premise of this document that software always exists in the context of a system. Since software does not operate without hardware, the processor upon which the software is executed can be considered as part of the system. Alternatively, hardware or services hosting the software system and handling communications with other systems can also be viewed as enabling systems or external systems in the operating environment. The perception and definition of a particular software system, its architecture, and its elements depend on a stakeholder's interests and responsibilities. One stakeholder's system-of-interest can be viewed as a system element in another stakeholder's system-of-interest. Furthermore, a system-of-interest can be viewed as being part of the environment for another stakeholder's system-of-interest. (ISO/IEC/IEEE 12207)

NOTE 3 The life cycle processes in this document are described in relation to a software system that is composed of interacting system elements (including software elements), each of which can be implemented to fulfil its respective specified requirements. Responsibility for the implementation of any system element may therefore be delegated to another party through an agreement. (ISO/IEC/IEEE 12207)

NOTE 4 Throughout the life cycle of a system-of-interest, essential services are required from systems that are not directly a part of the operational environment of the system-of-interest, e.g. modelling system, training system, maintenance system. Each of these systems enables a part, e.g. a stage of the life cycle of the system-of-interest to be conducted. Termed "enabling systems", they facilitate progression of the system-of-interest through its life cycle. (ISO/IEC/IEEE 12207)

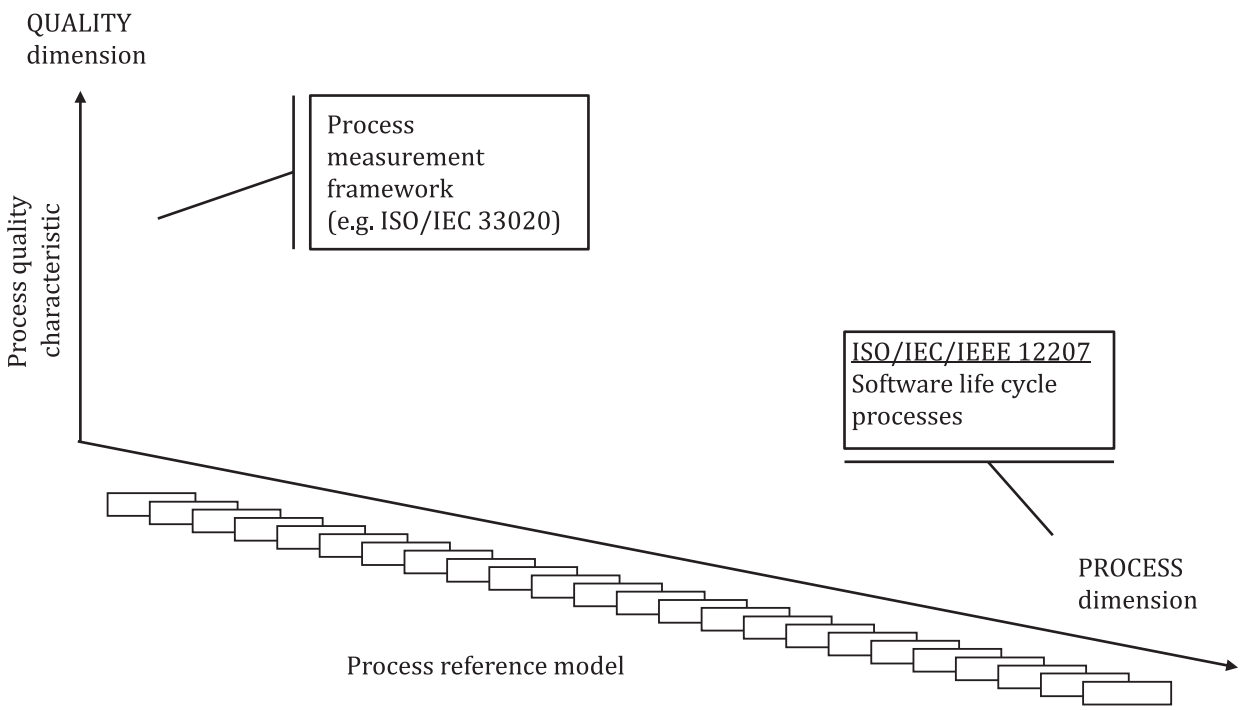

Figure 1 — Structure of the process assessment model

Figure 1 shows the process assessment model as a two-dimensional model, the process dimension with its relationship to ISO/IEC/IEEE 12207 software life cycle processes, and the quality dimension in relationship to a process measurement framework.

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

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4.2 Structure of the process assessment model

4.2.1 General

This subclause describes the detailed structure of the process assessment model and its key components.

The process dimension comprises the set of processes defined with process purpose and process outcomes together with a set of assessment indicators of process performance.

Processes included in a process reference model shall be in accordance with ISO/IEC 33004:2015, 5.4.

The processes in this document are derived directly from ISO/IEC/IEEE 12207 and meet the ISO/IEC 33004 requirements for process descriptions, process purposes and outcomes.

The quality dimension comprising a set of process attributes for a selected process quality characteristic is incorporated as a process measurement framework together with a set of process quality indicators.

NOTE ISO/IEC 33020 provides a process measurement framework for the assessment of process capability which can be incorporated into this document. ISO/IEC 33020 also includes a set of process quality indicators for each process attribute in the process measurement framework.

4.2.2 Processes

The process assessment model is based upon the software life cycle processes defined in ISO/IEC/IEEE 12207. The process reference model drawn from ISO/IEC/IEEE 12207 consists of the process purpose and outcomes defined in that standard. The purpose and outcomes are a statement of the goals of the performance of each process.

In this document, ISO/IEC/IEEE 12207 serves as the process reference model for process assessments; any other use of the processes shall adhere to the requirements of ISO/IEC/IEEE 12207.

Figure 2 lists the processes from ISO/IEC/IEEE 12207 that are included in the process dimension of the process assessment model and shows their classification into process groups.

The process groups and their associated processes are described in Clause 5. The description of each process group includes a characterization of the processes it contains. In this process assessment model, each process belonging to a group is identified with a process identifier (ID) consisting of the group abbreviated name and the sequential number of the process in that group.

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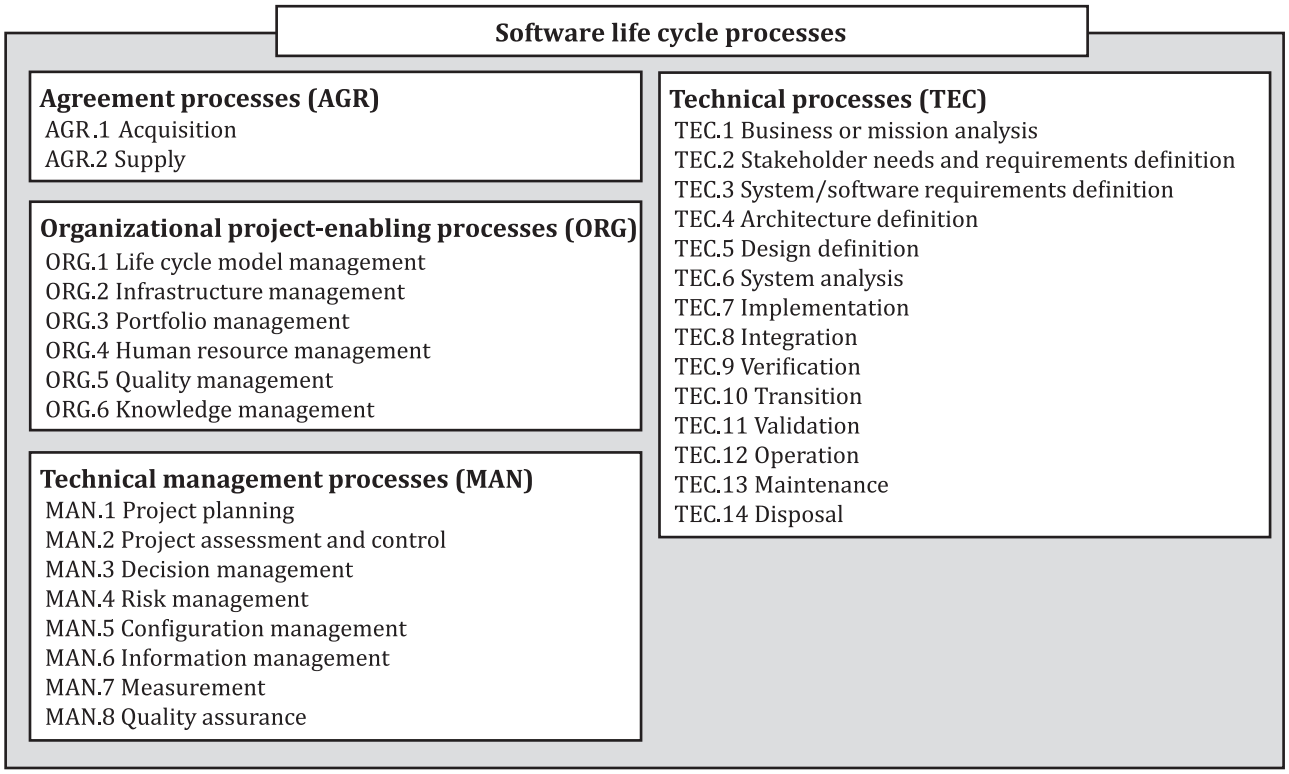

Figure 2 — Process groups

4.2.3 Process dimension

Each process has a process identifier (ID) consisting of the process group abbreviated name and the sequential number of the process in that group. Each process is described by its name, purpose, outcomes, base practices, and process outputs.

Each process is described in terms of a purpose statement. These statements contain the unique functional objectives of the process when performed in a particular environment. A list of specific process outcomes is associated with each of the process purpose statements, as a list of expected positive results of the process performance.

4.2.4 Quality dimension

For the quality dimension, the minimum requirement is that the process is performed, i.e. the implemented process achieves its process purpose and the expected outcomes are observable.

Process attributes are features of a process that can be evaluated on a scale of achievement, providing a measure of the quality of the process and are applicable to all processes.

4.3 Assessment indicators

A process assessment model is based on the principle that the quality of a process can be assessed by demonstrating the achievement of process attributes on the basis of evidences related to assessment indicators.

There are two types of assessment indicators: process performance indicators and process quality indicators. Process performance indicators address the process purpose and outcomes of each process in the process dimension. Process quality indicators demonstrate the achievement of the process attributes in the quality dimension.

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The process performance indicators are:

— base practice (BP);

— process output (PO).

The performance of base practices (BPs) provides an indication of the extent of achievement of the process purpose and process outcomes. The base practices correspond to ISO/IEC/IEEE 12207 activities and tasks. Process outputs (POs) are either used or produced (or both), when performing the process. Information items that are the key outputs of the process, are primarily used as performance indicators.

Annex A provides the list of process outputs associated with the processes in Clause 5. The process outputs are identified by categories. The process outputs are indicated by the process IDs.

Process quality indicators depend on the process quality characteristic of interest. The minimum requirement is that at least one of the process attributes shall comprise the achievement of the defined process purpose and process outcomes for the process; this is termed the process performance attribute (see ISO/IEC 33003:2015, 4.2.1). Other process quality attributes can be defined as needed.

The process performance and process quality indicators represent types of objective evidence that can be found in an instantiation of a process and therefore can be used to judge achievement of quality. Figure 3 shows how the assessment indicators are related to process performance and process quality.

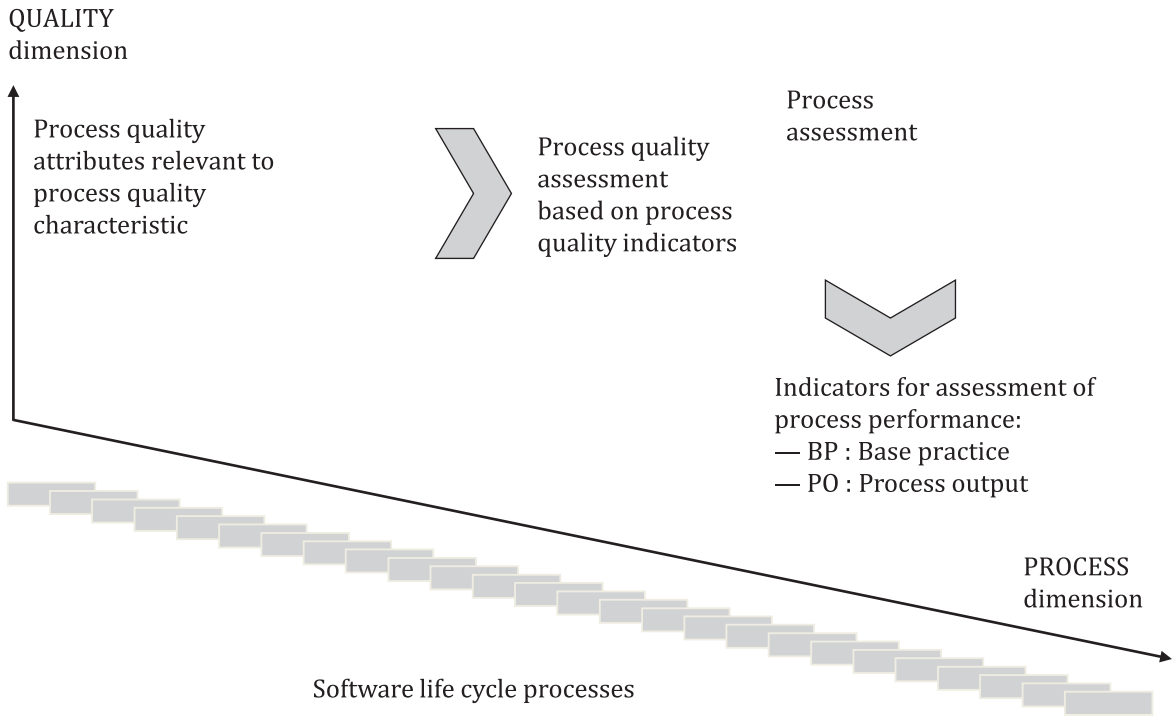

Figure 3 — Assessment indicators

5 The process dimension

5.1 General

The process dimension comprises the set of processes defined with process purpose and process outcomes together with a set of assessment indicators of process performance.

The individual processes each have a process identifier (ID) consisting of the process group abbreviated name and the sequential number of the process in that group and are described in terms of process

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name, process purpose, and process outcomes as defined in ISO/IEC/IEEE 12207. The process group descriptions are compiled from ISO/IEC/IEEE 12207.

In addition, the process dimension of the process assessment model provides information in the form of a set of:

a) base practices for the process providing a definition of the tasks and activities needed to accomplish the process purpose and fulfil the process outcomes; each base practice is associated to one or more process outcomes;

b) process outputs that are related to one or more process outcomes;

The process purposes, outcomes, base practices and process outputs associated with the processes are included in this clause. The base practices and process outputs constitute the set of indicators of process performance.

A documented assessment process and assessor judgment is needed to ensure that process context (application domain, business purpose, development methodology, size of the organization, etc.) is explicitly considered when using this information.

5.2 Agreement processes (AGR)

5.2.1 General

Organizations are producers and users of software systems. One organization (acting as an acquirer) can task another (acting as a supplier) for products or services. This is achieved using agreements. Agreements allow both acquirers and suppliers to realize value and support business strategies for their organizations.

The agreement processes are organizational processes that apply outside of the span of a project's life, as well as for a project's lifespan. Generally, organizations act simultaneously or successively as both acquirers and suppliers of software systems. The agreement processes can be used with less formality when the acquirer and the supplier are in the same organization. Similarly, they can be used within the organization to agree on the respective responsibilities of organization, project and technical functions.

This subclause specifies the requirements for the establishment of agreements with organizational entities external and internal to the organization.

The agreement processes consist of the following:

a) acquisition process – used by organizations for acquiring products or services;

b) supply process – used by organizations for supplying products or services.

These processes define the activities necessary to establish an agreement between two organizations. If the acquisition process is invoked, it provides the means for conducting business with a supplier. This may include products that are supplied for use as an operational software system, services in support of operational activities, software elements of a system, or elements of a software system being provided by a supplier. If the supply process is invoked, it provides the means for an agreement in which the result is a product or service that is provided to the acquirer.

NOTE Security is an increasing concern in systems and software engineering. See ISO/IEC 27036 (all parts) for requirements and guidance for suppliers and acquirers on how to secure information in supplier relationships. Specific aspects of information security supplier relationships are addressed in ISO/IEC 27036-3:2013 and ISO/IEC 27036-4. (ISO/IEC/IEEE 12207)

5.2.2 Acquisition process

Process ID	**AGR.1**
Process name	**Acquisition process**

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Process purpose	The purpose of the acquisition process is to obtain a product or service in accordance with the acquirer's requirements. NOTE As part of this process, the agreement is modified when a change request is agreed to by both the acquirer and supplier.
Process outcomes	As a result of the successful implementation of the acquisition process: a) A request for supply is prepared. b) One or more suppliers are selected. c) An agreement is established between the acquirer and supplier. d) A product or service complying with the agreement is accepted. e) Acquirer obligations defined in the agreement are satisfied.
Base practices	**AGR.1.BP1: Prepare for the acquisition.** [Outcome: a] 1) Define a strategy for how the acquisition will be conducted. 2) Prepare a request for the supply of a product or service that includes the requirements. **AGR.1.BP2: Advertise the acquisition and select the supplier.** [Outcome: b] 1) Communicate the request for the supply of a product or service to potential suppliers. 2) Select one or more suppliers. **AGR.1.BP3: Establish and maintain an agreement.** [Outcome: c, d] 1) Develop an agreement with the supplier that includes acceptance criteria. 2) Identify necessary changes to the agreement. 3) Evaluate impact of changes on the agreement. 4) Negotiate the agreement with the supplier. 5) Update the agreement with the supplier, as necessary. **AGR.1.BP4: Monitor the agreement.** [Outcome: d, e] 1) Assess the execution of the agreement. 2) Provide data needed by the supplier and resolve issues in a timely manner. **AGR.1.BP5: Accept the product or service.** [Outcome: d, e] 1) Confirm that the delivered product or service complies with the agreement. 2) Provide payment or other agreed consideration. 3) Accept the product or service from the supplier, or other party, as directed by the agreement. 4) Close the agreement.
Process outputs	Acquisition approach [Outcome: a] Request for supply [Outcome: a] Acquisition agreement [Outcome: c] Acquisition agreement change request [Outcome: c] Accepted system or system element (e.g. software) [Outcome: d] Acquisition report [Outcome: e] Acquisition record [Outcome: e]

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5.2.3 Supply process

Process ID	**AGR.2**
Process name	**Supply process**
Process purpose	The purpose of the Supply process is to provide an acquirer with a product or service that meets agreed requirements.
Process outcomes	As a result of the successful implementation of the Supply process: a) An acquirer for a product or service is identified. b) A response to the acquirer's request is produced. c) An agreement is established between the acquirer and supplier. d) A product or service is provided. e) Supplier obligations defined in the agreement are satisfied. f) Responsibility for the acquired product or service, as directed by the agreement, is transferred.
Base practices	**AGR.2.BP1: Prepare for the supply.** [Outcome: a] 1) Determine the existence and identity of an acquirer who has a need for a product or service. 2) Define a supply strategy. **AGR.2.BP2: Respond to a request for supply of products or services.** [Outcome: b] 1) Evaluate a request for the supply of a product or service to determine feasibility and how to respond. 2) Prepare a response that satisfies the solicitation. **AGR.2.BP3: Establish and maintain an agreement.** [Outcome: c] 1) Negotiate an agreement with the acquirer that includes acceptance criteria. 2) Identify necessary changes to the agreement. 3) Evaluate impact of changes on the agreement. 4) Negotiate the agreement with the acquirer, as necessary. 5) Update the agreement with the acquirer, as necessary. **AGR.2.BP4: Execute the agreement.** [Outcome: d, e] 1) Execute the agreement according to the established project plans. 2) Assess the execution of the agreement. **AGR.2.BP5: Deliver and support the product or service.** [Outcome: d, e, f] 1) Deliver the product or service in accordance with the agreement criteria. 2) Provide assistance to the acquirer in support of the delivered product or service, per the agreement. 3) Accept and acknowledge payment or other agreed consideration. 4) Transfer the product or service to the acquirer, or other party, as directed by the agreement. 5) Close the agreement.

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Process outputs	Supply approach [Outcome: a] Request for supply response [Outcome: b] Supply agreement [Outcome: c] Supply agreement change request [Outcome: c] Supplied system [Outcome: d] Supply report [Outcome: e, f] Supply record [Outcome: e, f]

NOTE As part of this process, the agreement is modified when a change request affecting the terms of the agreement is agreed to by both the acquirer and supplier. (ISO/IEC/IEEE 12207)

5.3 Organizational project-enabling processes (ORG)

5.3.1 General

The organizational project-enabling processes are concerned with providing the resources to enable the project to meet the needs and expectations of the organization's stakeholders. The organizational project-enabling processes are typically concerned at a strategic level with the management and improvement of the organization's business or undertaking, with the provision and deployment of resources and assets, and with its management of risks in competitive or uncertain situations. The organizational project-enabling processes apply outside the span of a project's life, as well as during a project's lifespan.

The organizational project-enabling processes establish the environment in which projects are conducted. The organization establishes the processes and life cycle models to be used by projects; establishes, redirects, or cancels projects; provides resources required, including human and financial; and sets and monitors the quality measures for software systems and other deliverables that are developed by projects for internal and external customers.

The organizational project-enabling processes create a strong business image for many organizations and imply commercial and profit-making motives. Nevertheless, the organizational project-enabling processes are equally relevant to non-profit organizations, since they are also accountable to stakeholders, are responsible for resources, and encounter risk in their undertakings. This document can be applied to non-profit organizations as well as to profit-making organizations.

The organizational project-enabling processes help ensure the organization's capability to acquire and supply products or services through the initiation, support and control of projects. These processes provide resources and infrastructure necessary to support projects and help ensure the satisfaction of organizational objectives and established agreements. They are not intended to be a comprehensive set of business processes that enable strategic management of the organization's business.

5.3.2 Life cycle model management process

Process ID	**ORG.1**
Process name	**Life cycle model management process**
Process purpose	The purpose of the life cycle model management process is to define, maintain, and assure availability of policies, life cycle processes, life cycle models, and procedures for use by the organization with respect to the scope of this document. This process provides life cycle policies, processes, models, and procedures that are consistent with the organization's objectives, that are defined, adapted, improved and maintained to support individual project needs within the context of the organization, and that are capable of being applied using effective, proven methods and tools.

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Process outcomes	As a result of the successful implementation of the life cycle model management process: a) Organizational policies and procedures for the management and deployment of life cycle models and processes are established. b) Responsibility, accountability, and authority within life cycle policies, processes, models, and procedures are defined. c) Life cycle models and processes for use by the organization are assessed. d) Prioritized process, model, and procedure improvements are implemented.
Base practices	**ORG.1.BP1: Establish the process.** [Outcome: a, b] 1) Establish policies and procedures for process management and deployment that are consistent with organizational strategies. 2) Establish the processes that implement the requirements of this document and that are consistent with organizational strategies. 3) Define the roles, responsibilities, accountabilities, and authorities to facilitate implementation of processes and the strategic management of life cycles. 4) Define business criteria that control progression through the life cycle. 5) Establish standard life cycle models for the organization that are comprised of stages, and define the purpose and outcomes for each stage. **ORG.1.BP2: Assess the process.** [Outcome: c] 1) Monitor process execution across the organization. 2) Conduct periodic reviews of the life cycle models used by the projects. 3) Identify improvement opportunities from assessment results. **ORG.1.BP3: Improve the process.** [Outcome: d] 1) Prioritize and plan improvement opportunities. 2) Implement improvement opportunities and inform relevant stakeholders.
Process outputs	Life cycle model management strategy [Outcome: a, c, d] Organization policy [Outcome: a, b] Organization procedure [Outcome: a, b] Life cycle models [Outcome: a, b] Organizational measurement needs [Outcome: c, d] Organizational performance data [Outcome: c, d] Life cycle model management report [Outcome: c, d] Life cycle model management record [Outcome: c, d]

5.3.3 Infrastructure management process

Process ID	**ORG.2**
Process name	**Infrastructure management process**
Process purpose	The purpose of the infrastructure management process is to provide the infrastructure and services to projects to support organization and project objectives throughout the life cycle. This process defines, provides and maintains the facilities, tools, and communications and information technology assets needed for the organization's business with respect to the scope of this document.

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Process outcomes	As a result of the successful implementation of the infrastructure management process: a) The requirements for infrastructure are defined. b) The infrastructure elements are identified and specified. c) Infrastructure elements are developed or acquired. d) The infrastructure is available.
Base practices	**ORG.2.BP1: Establish the infrastructure.** [Outcome: a, b, c, d] 1) Define project infrastructure requirements. 2) Identify, obtain and provide infrastructure resources and services that are needed to implement and support projects. **ORG.2.BP2: Maintain the infrastructure.** [Outcome: a, b, c, d] 1) Evaluate the degree to which delivered infrastructure resources satisfy project needs. 2) Identify and provide improvements or changes to the infrastructure resources as the project requirements change.
Process outputs	Infrastructure management strategy [Outcome: b, c] Infrastructure requirements [Outcome: a] Organization infrastructure [Outcome: b, c, d] Infrastructure change requests [Outcome: b, c] Infrastructure management report [Outcome: d] Infrastructure management record [Outcome: d]

5.3.4 Portfolio management process

Process ID	**ORG.3**
Process name	**Portfolio management process**
Process purpose	The purpose of the portfolio management process is to initiate and sustain necessary, sufficient and suitable projects in order to meet the strategic objectives of the organization. This process commits the investment of adequate organization funding and resources, and sanctions the authorities needed to establish selected projects. It performs continued assessment of projects to confirm they justify, or can be redirected to justify, continued investment.
Process outcomes	As a result of the successful implementation of the portfolio management process: a) Business venture opportunities, investments or necessities are qualified and prioritized. b) Projects are identified. c) Resources and budgets for each project are allocated. d) Project management responsibilities, accountability, and authorities are defined. e) Projects meeting agreement and stakeholder requirements are sustained. f) Projects not meeting agreement or satisfying stakeholder requirements are redirected or terminated. g) Projects that have completed agreements and satisfied stakeholder requirements are closed.

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Base practices	**ORG.3.BP1: Define and authorize projects.** [Outcome: a, b, c, d] 1) Identify potential new or modified capabilities or missions. 2) Prioritize, select and establish new business opportunities, ventures or undertakings. 3) Define projects, accountabilities and authorities. 4) Identify the expected goals, objectives, and outcomes of each project. 5) Identify and allocate resources for the achievement of project goals and objectives. 6) Identify multi-project interfaces and dependencies to be managed or supported by each project. 7) Specify the project reporting requirements and review milestones that govern the execution of each project. 8) Authorize each project to commence execution of project plans. **ORG.3.BP2: Evaluate the portfolio of projects.** [Outcome: e, f] 1) Evaluate projects to confirm ongoing viability. 2) Act to continue or redirect projects that are satisfactorily progressing or can be expected to progress satisfactorily by appropriate redirection. **ORG.3.BP3: Terminate projects.** [Outcome: f, g] 1) Where agreements permit, act to cancel or suspend projects whose disadvantages or risks to the organization outweigh the benefits of continued investments. 2) After completion of the agreement for products and services, act to close the projects.
Process outputs	Portfolio management strategy [Outcome: a, b, c, d, e, f, g] Project portfolio [Outcome: a, b] Project authorization [Outcome: c, d] Project direction [Outcome: e, f, g] Organization lessons learned [Outcome: e, f, g] Portfolio management report [Outcome: e, f, g] Portfolio management record [Outcome: e, f, g]

NOTE For software systems, portfolio management also commonly refers to the management of a product line (portfolio of assets, products, and enabling systems, or service catalogue) to meet organizational or customer needs and objectives and support changes in technology. Management of assets is achieved through management of projects. (ISO/IEC/IEEE 12207)

5.3.5 Human resource management process

Process ID	**ORG.4**
Process name	**Human resource management process**
Process purpose	The purpose of the human resource management process is to provide the organization with necessary human resources and to maintain their competencies, consistent with business needs. This process provides a supply of skilled and experienced personnel qualified to perform life cycle processes to achieve organization, project, and stakeholder objectives.

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Process outcomes	As a result of the successful implementation of the human resource management process: a) Skills required by projects are identified. b) Necessary human resources are provided to projects. c) Skills of personnel are developed, maintained or enhanced. d) Conflicts in multi-project resource demands are resolved.
Base practices	**ORG.4.BP1: Identify skills.** [Outcome: a, c] 1) Identify skill needs based on current and expected projects. 2) Identify and record skills of personnel. **ORG.4.BP2: Develop skills.** [Outcome: a, c] 1) Establish skills development strategy. 2) Obtain or develop training, education or mentoring resources. 3) Provide planned skill development. 4) Maintain records of skill development. **ORG.4.BP3: Acquire and provide skills**. [Outcome: b, c, d] 1) Obtain qualified personnel when skill deficits are identified. 2) Maintain and manage the pool of skilled personnel necessary to staff ongoing projects. 3) Make project assignments based on project and staff-development needs. 4) Motivate personnel, e.g. through career development and reward mechanisms. 5) Control multi-project management interfaces to resolve personnel conflicts.
Process outputs	Human resource management strategy [Outcome: a, b, c, d] Human resource requirements [Outcome: a] Qualified personnel [Outcome: b, c, d] Human resource management report [Outcome: c, d] Human resource management record [Outcome: c, d]

5.3.6 Quality management process

Process ID	**ORG.5**
Process name	**Quality management process**
Process purpose	The purpose of the quality management process is to assure that products, services and implementations of the quality management process meet organizational and project quality objectives and achieve customer satisfaction.
Process outcomes	As a result of the successful implementation of the quality management process: a) Organizational quality management policies, objectives, and procedures are defined and implemented. b) Quality evaluation criteria and methods are established. c) Resources and information are provided to projects to support the operation and monitoring of project quality assurance activities. d) Quality assurance evaluation results are gathered and analysed. e) Quality management policies and procedures are improved based upon project and organizational results.

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Base practices	**ORG.5.BP1: Plan quality management.** [Outcome: a, b, c] 1) Establish quality management policies, objectives, and procedures. 2) Define responsibilities and authority for implementation of quality management. 3) Define quality evaluation criteria and methods. 4) Provide resources and information for quality management. **ORG.5.BP2: Evaluate quality management.** [Outcome: b, d] 1) Gather and analyse quality assurance evaluation results, in accordance with the defined criteria. 2) Assess customer satisfaction. 3) Conduct periodic reviews of project quality assurance activities for compliance with the quality management policies, objectives, and procedures. 4) Monitor the status of quality improvements on processes, products, and services. **ORG.5.BP3: Perform corrective and preventive action.** [Outcome: d, e] 1) Plan corrective actions when quality management objectives are not achieved. 2) Plan preventive actions when there is a sufficient risk that quality management objectives will not be achieved. 3) Monitor corrective and preventive actions to completion and inform relevant stakeholders.
Process outputs	Quality management strategy [Outcome: a, b] Quality management criteria and methods [Outcome: b] Quality management system [Outcome: a, b, c, d, e] Quality management corrective action [Outcome: c, e] Quality management report [Outcome: d, e] Quality management evaluation report [Outcome: d] Quality management record [Outcome: d, e]

NOTE Refer to ISO 9001 for information and requirements to establish a quality management system. (ISO/IEC/IEEE 12207)

5.3.7 Knowledge management process

Process ID	**ORG.6**
Process name	**Knowledge management process**
Process purpose	The purpose of the knowledge management process is to create the capability and assets that enable the organization to exploit opportunities to re-apply existing knowledge. This encompasses knowledge, skills, and knowledge assets, including system elements.
Process outcomes	As a result of the successful implementation of the knowledge management process: a) A taxonomy for the application of knowledge assets is identified. b) The organizational knowledge, skills, and knowledge assets are developed or acquired. c) The organizational knowledge, skills, and knowledge assets are available. d) Knowledge management usage data is gathered and analysed.

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Base practices	**ORG.6.BP1: Plan knowledge management.** [Outcome: a, b] 1) Define the knowledge management strategy. 2) Identify the knowledge, skills, and knowledge assets to be managed. 3) Identify projects that can benefit from the application of the knowledge, skills, and knowledge assets. **ORG.6.BP2: Share knowledge and skills throughout the organization.** [Outcome: b, c] 1) Establish and maintain a classification for capturing and sharing knowledge and skills across the organization. 2) Capture or acquire knowledge and skills. 3) Share knowledge and skills across the organization. **ORG.6.BP3: Share knowledge assets throughout the organization.** [Outcome: b, c] 1) Establish a taxonomy to organize knowledge assets. 2) Develop or acquire knowledge assets. 3) Share knowledge assets across the organization. **ORG.6.BP4: Manage knowledge, skills, and knowledge assets.** [Outcome: b, c, d] 1) Maintain knowledge, skills, and knowledge assets. 2) Monitor and record the reuse of knowledge, skills, and knowledge assets. 3) Periodically reassess the currency of technology and market needs for the knowledge assets.
Process outputs	Knowledge management strategy [Outcome: a] Knowledge management system [Outcome: b, c] Knowledge asset [Outcome: b] Knowledge management report [Outcome: d]

NOTE The re-application of existing knowledge is known as knowledge reuse and includes the reuse of knowledge about or from software elements. (ISO/IEC/IEEE 12207)

5.4 Technical management processes (MAN)

5.4.1 General

The technical management processes are concerned with managing the resources and assets allocated by organization management and with applying them to fulfil the agreements into which the organization or organizations enter. The technical management processes relate to the technical effort of projects, in particular to planning in terms of cost, timescales and achievements, to the checking of actions to help ensure that they comply with plans and performance criteria and to the identification and selection of corrective actions that recover shortfalls in progress and achievement. These processes are used to establish and perform technical plans for the project, manage information across the technical team, assess technical progress against the plans for the software system, products, or services, control technical tasks through to completion, and aid in decision-making.

Typically, several projects co-exist in one organization. The technical management processes can be employed at a corporate level to meet internal needs.

The technical management processes are used to establish and evolve plans, to execute the plans, to assess actual achievement and progress against the plans, and to control execution through to fulfilment. Individual technical management processes may be invoked at any time in the life cycle

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and at any level in a hierarchy of projects, as required by plans or unforeseen events. The technical management processes are applied with a level of rigor and formality that depends on the risk and complexity of the project.

The scope of a technical management process is the technical management of a project or its products, to include the software product or system-of-interest.

Project planning and project assessment and control processes are key to all management practices. These processes establish the general approach for managing a project or a process. The other processes in this group provide a specific focused set of tasks for achieving a specialized management objective. They are all evident in the management of any undertaking, ranging from a complete organization down to a single life cycle process and its tasks. In this document, the project has been chosen as the context for describing processes. The same processes can also be applied in the performance of services.

5.4.2 Project planning process

Process ID	**MAN.1**
Process name	**Project planning process**
Process purpose	The purpose of the project planning process is to produce and coordinate effective and workable plans. This process determines the scope of the project management and technical activities, identifies process outputs, tasks and deliverables, establishes schedules for task conduct, including achievement criteria, and required resources to accomplish tasks. This is an on-going process that continues throughout a project, with regular revisions to plans.
Process outcomes	As a result of the successful implementation of the project planning process: a) Objectives and plans are defined. b) Roles, responsibilities, accountabilities, authorities are defined. c) Resources and services necessary to achieve the objectives are formally requested and committed. d) Plans for the execution of the project are activated.

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Base practices	**MAN.1.BP1: Define the project.** [Outcome: a, b] 1) Identify the project objectives and constraints. 2) Define the project scope as established in the agreement. 3) Define and maintain a life cycle model that is comprised of stages using the defined life cycle models of the organization. 4) Establish a work breakdown structure (WBS) based on the deliverable products or the evolving architecture of the software system. 5) Define and maintain the processes that will be applied on the project. **MAN.1.BP2: Plan project and technical management.** [Outcome: b, c] 1) Define and maintain a project schedule based on management and technical objectives and work estimates. 2) Define achievement criteria for the life cycle stage decision gates, delivery dates and major dependencies on external inputs or outputs. 3) Define the costs and plan a budget. 4) Define roles, responsibilities, accountabilities, and authorities. 5) Define the infrastructure and services required. 6) Plan the acquisition of materials and enabling systems and services supplied from outside the project. 7) Generate and communicate a plan for project and technical management and execution, including reviews. **MAN.1.BP3: Activate the project.** [Outcome: c, d] 1) Obtain approval for the project. 2) Submit requests and obtain commitments for necessary resources to perform the project. 3) Implement project plans.
Process outputs	Project objectives [Outcome: a] Project constraints [Outcome: a] Project plan (e.g. software development plan) [Outcome: a] Project budget [Outcome: b, c] Work breakdown structure [Outcome: b, c] Project schedule [Outcome: b, c] Project infrastructure needs [Outcome: c] Project human resources needs [Outcome: c] Acquisition need [Outcome: c] Project planning record [Outcome: d]

NOTE The strategies defined in each of the other processes provide inputs and are integrated in the project planning process. The project assessment and control process is used to assess whether the plans are integrated, aligned, and feasible. (ISO/IEC/IEEE 12207)

5.4.3 Project assessment and control process

Process ID	**MAN.2**
Process name	**Project assessment and control process**

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