



**International
Standard**

**ISO/IEC
29110-5-6-4**

**Systems and software
engineering — Life cycle profiles for
very small entities (VSEs) —**

**Part 5-6-4:
Systems engineering guidelines for
the generic Advanced profile**

**First edition
2025-03**



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Foreword

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

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 document 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).

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

A list of all parts in the ISO/IEC 29110 series can be found on the ISO and IEC websites.

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.

Introduction

0.1 Introduction to the ISO/IEC 29110 series

Very small entities (VSEs) around the world are creating valuable products and services. For the purpose of ISO/IEC 29110 series, a VSE is an enterprise, organization (e.g. government agency, non-profit organization), department or project having up to 25 people. Many VSEs develop and/or maintain systems and software components used in those systems, either as independent products or incorporated in the larger systems. Due to this a recognition of VSEs as suppliers of high-quality products is required.

VSEs around the world are creating valuable products and services. According to the World Bank, small and medium-sized enterprises (SMEs) account for about 90 % of enterprises worldwide. According to the Organisation for Economic Co-operation and Development (OECD), SMEs represent 99 % of all businesses and generate about 60 % of employment. Almost one person out of three is employed in a micro firm with less than 10 employees. The European Union reports that micro firms, with fewer than 10 persons, account for 93,5 % of all enterprises and small firms, with 10 to 49 employees, account for 5,5 % of all enterprises. The challenge facing OECD governments is to provide a business environment that supports the competitiveness of this large heterogeneous business population and that promotes a vibrant entrepreneurial culture.

From studies and surveys conducted, it is clear that the majority of International Standards do not address the needs of VSEs. Implementation of and conformity with these standards is difficult, if not impossible.

Consequently, VSEs have no, or very limited, ways to be recognized as entities that produce quality systems/system elements including software in their domain. Therefore, VSEs are excluded from some economic activities.

It has been found that VSEs find it difficult to relate International Standards to their business needs and to justify the effort required to apply standards to their business practices. Most VSEs can neither afford the resources, in terms of the number of employees, expertise, budget and time, nor do they see a net benefit in establishing over-complex systems or software life cycle processes. To address some of these difficulties, a set of guidelines has been developed based on a set of VSE characteristics. The guidelines are based on subsets of appropriate standards processes, activities, tasks, and outcomes, referred to as Profiles. The purpose of a profile is to define a subset of International Standards relevant to the VSEs' context; for example, processes, activities, tasks, and outcomes of ISO/IEC/IEEE 12207 for software; and processes, activities, tasks, and outcomes of ISO/IEC/IEEE 15288 for systems; and information products (documentation) of ISO/IEC/IEEE 15289 for software and systems.

VSEs can achieve recognition through implementing a profile and by being audited against the specifications of the ISO/IEC 29110 series.

The ISO/IEC 29110 series can be applied at any phase of system or software development within a life cycle. This series is intended to be used by VSEs that do not have experience or expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 standards to the needs of a specific project. VSEs that have expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 are encouraged to use those standards instead of ISO/IEC 29110.

The ISO/IEC 29110 series is intended to be used with any life cycle such as waterfall, iterative, incremental, evolutionary or agile.

Systems, in the context of the ISO/IEC 29110 series, are typically composed of hardware and software components.

The ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality, and process performance. Figure 1 describes the ISO/IEC 29110 series and positions the parts within the framework of reference.

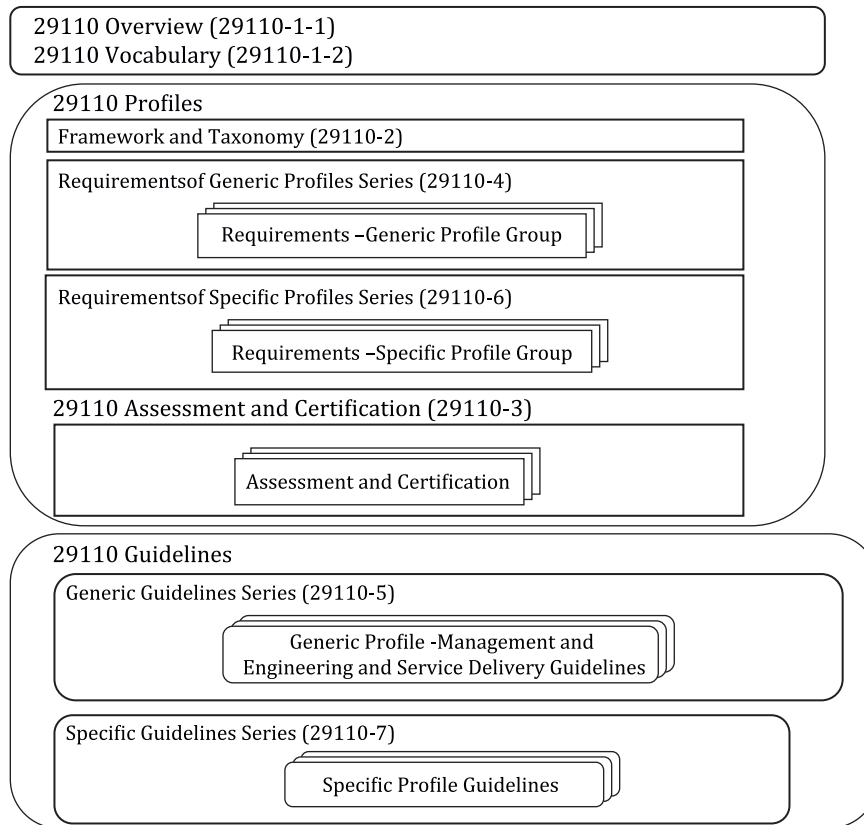


Figure 1 — The ISO/IEC 29110 series

ISO/IEC 29110-1-1 introduces processes, life cycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. ISO/IEC 29110-1-1 also introduces the characteristics and needs of a VSE, and clarifies the rationale for specific profiles, documents, standards and guidelines. ISO/IEC 29110-1-2 defines the terms common to the ISO/IEC 29110 series. ISO/IEC 29110-1-1 and ISO/IEC 29110-1-2 are targeted at VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.

ISO/IEC 29110-2 introduces the concepts for systems and software engineering profiles for VSEs. It establishes the logic behind the definition and application of profiles. For standardized profiles, it specifies the elements common to all profiles (structure, requirements, conformity, and assessment). For domain-specific profiles (profiles that are not standardized and developed outside of the ISO process), it provides general guidance adapted from the definition of standardized profiles. ISO/IEC 29110-2 is targeted at profile producers, tool vendors and methodology vendors.

ISO/IEC 29110-3 defines certification schemes, assessment guidelines and compliance requirements for process capability assessment, conformity assessments, and self-assessments for process improvements. ISO/IEC 29110-3 also contains information that can be useful to developers of certification and assessment methods and developers of certification and assessment tools. ISO/IEC 29110-3 is addressed to people who have direct involvement with the assessment process, for example, the auditor, certification and accreditation bodies and the sponsor of the audit, who need guidance on ensuring that the requirements for performing an audit have been met. ISO/IEC 29110-3 is targeted at VSEs and their customers, assessors, accreditation bodies.

ISO/IEC 29110-4 provides the specifications for all generic profiles of the generic profile group that are based on subsets of appropriate standards elements. ISO/IEC 29110-4 is targeted at VSEs, customers, standards producers, tool vendors and methodology vendors.

ISO/IEC 29110-5 provides a management, engineering and service delivery guidelines for profiles of the generic profile group. ISO/IEC 29110-5 is targeted at VSEs and their customers.

ISO/IEC 29110-6 provides the specifications for specific profiles that are based on subsets of appropriate standards elements. ISO/IEC 29110-6 is targeted at VSEs, customers, standards producers, tool vendors and methodology vendors.

ISO/IEC 29110-7 provides a guideline for each profile of the specific profile group. ISO/IEC 29110-7 is targeted at VSEs and their customers.

If a new profile is needed, ISO/IEC 29110-4, ISO/IEC 29110-6, ISO/IEC 29110-7 or ISO/IEC 29110-5, or all, can be developed with minimal impact to existing documents.

These guidelines are oriented towards the management of more than one project in parallel with more than one work team.

0.2 Introduction to this document

This document has been developed using the management and engineering guidelines from the systems engineering Intermediate profile. Elements were added or modified (e.g. process, task, work product, role) to support VSEs involved in the development of more than one project in parallel with more than one work team.

This document is intended to be used with any process, technique and method that enhances the VSE's stakeholder satisfaction and productivity.

The Advanced profile is the fourth profile of a four-profile systems engineering roadmap (i.e. Entry, Basic, Intermediate and Advanced).

The outcomes and tasks are guidance, not requirements, for purposes of process assessment.

This document applies for the development of non-safety critical systems.

Using this document, a VSE can obtain benefits in the following aspects:

- systematic system definition and realization process is followed, that satisfies the acquirer needs and helps ensure quality work processes are followed;
- management and monitoring of more than one project in parallel with more than one work team;
- reuse of existing system components (e.g. code and document) in new projects;
- continuous measurement and evaluation of projects;
- continuous evaluation and improvement processes;
- continuous sustainability and growth;
- support to customers in the disposal of a current system and installation of a new system.

Once the system, developed by a VSE, has been accepted by their customers, the VSE can provide after delivery services by referring to ISO/IEC 29110-5-3.

To use this document, the VSE should ensure the following entry conditions:

- project needs and expectations are documented;
- feasibility of the project was performed;
- project team, including project manager and system engineer, assigned;
- goods, services and infrastructure to start the project are available.

In the context of systems engineering, that is the system definition and realization (SR) process, the group that is part of the VSE responsible for developing software elements that are part of the system, should use the management and engineering guidelines of the software engineering Advanced profile (ISO/IEC TR 29110-5-1-4).

ISO/IEC 29110-5-6-4:2025(en)

To use this document, a VSE should be familiar with or have implemented ISO/IEC TR 29110-5-6-3, the systems engineering Intermediate profile, for their system development projects.

Systems and software engineering — Life cycle profiles for very small entities (VSEs) —

Part 5-6-4: Systems engineering guidelines for the generic Advanced profile

1 Scope

This document describes processes targeted at VSEs that want to sustain and grow as an independent competitive system development organization.

This document provides management and engineering guidelines for the systems engineering Advanced profile of the generic profile group.

This document is applicable to VSEs that do not develop critical systems and have little or no experience with systems engineering (SE) process planning and implementation using the ISO/IEC/IEEE 15288.

This document is also applicable to VSEs which are familiar with the management and engineering guidelines of the systems engineering Intermediate profile (ISO/IEC TR 29110 5-6-3) for their system development projects and are involved in the development of more than one project in parallel with more than one work team.

2 Normative references

This document has no normative references.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 Advanced profile

profile (3.14) targeted at VSEs which want to sustain and grow as a *system* (3.19) and/or software development organization

[SOURCE: ISO/IEC 29110-1-2:2024, 3.3, modified — "competitive system" has been changed to "system".]

3.2 agreement

mutual acknowledgement of terms and conditions under which a working relationship is conducted

EXAMPLE Contract, memorandum of agreement.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.4]

3.3

acquirer

stakeholder (3.18) that acquires or procures a product or service from a supplier

Note 1 to entry: Other terms commonly used for an acquirer are buyer, customer, owner, purchaser or internal/organizational sponsor.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.1]

3.4

Basic profile

profile (3.14) targeted at VSEs developing a single product by a single work team

[SOURCE: ISO/IEC 29110-1-2: 2024, 3.18]

3.5

business objective

strategy designed by senior management to ensure an organization's continued existence and enhance its profitability, market share, and other factors influencing the organization's success

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.444]

3.6

conditional process

process that may be mandatory under some specified conditions, may be optional under other specified conditions, and may be out of scope or not applicable under other specified conditions

Note 1 to entry: These are to be observed if the specified conditions apply.

[SOURCE: ISO/IEC TR 29110-5-1-3:2017, 3.3]

3.7

critical system

product that is essential to the operation of a business or organization, whose sustained failure would result in significant business impacts e.g. loss of revenue or loss of reputation

3.8

disposed system

system (3.19) that has been transformed (i.e. state change) by applying the disposal process

Note 1 to entry: A systems approach considers the total system and the total life cycle of the system. This includes all aspects of the system throughout its life until the day *users* (3.24) dispose of the system and the external enterprises complete the handling of the disposed system products.

3.9

enabling system

system (3.19) that supports a system-of-interest during its life cycle stages but does not necessarily contribute directly to its function during operation

EXAMPLE Production-enabling system, which is required when a system-of-interest enters the production stage.

Note 1 to entry: Each enabling system has a life cycle of its own. This document is applicable to each enabling system when, in its own right, it is treated as a system-of-interest.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.15]

3.10

Entry profile

profile (3.14) targeted at start-up VSEs (i.e. VSEs who started their operation less than 3 years) and/or at VSEs working on small projects (e.g. project size of less than 6 person-months)

[SOURCE: ISO/IEC 29110-1-2:2024, 3.42]

3.11

generic profile group

profile (3.14) group applicable to VSEs (very small entities) that do not develop *critical systems* (3.7) or software products

[SOURCE: ISO/IEC 29110-1-2:2024, 3.45]

3.12

Intermediate profile

profile (3.14) targeted at VSEs involved in the development of more than one project in parallel with more than one work team

[SOURCE: ISO/IEC 29110-1-2:2024, 3.51]

3.13

operator

individual or organization that performs the operations of a *system* (3.19)

Note 1 to entry: The role of operator and the role of *user* (3.24) can be vested, simultaneously or sequentially, in the same individual or organization.

Note 2 to entry: An individual operator combined with knowledge, skills and procedures can be considered as an element of the system.

Note 3 to entry: An operator may perform operations on a system that is operated, or of a system that is operated, depending on whether or not operating instructions are placed within the system boundary.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.24]

3.14

profile

subset of appropriate standards' processes and their outcomes, activities and tasks combined to accomplish a particular function

Note 1 to entry: The base standards used to develop profiles for VSEs are ISO/IEC/IEEE 12207, ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 15289.

3.15

process purpose

high-level objective of performing the process and the likely outcomes of effective implementation of the process

[SOURCE: ISO/IEC/IEEE 24774:2021, 3.12]

3.16

process outcome

observable result of the successful achievement of the *process purpose* (3.15)

[SOURCE: ISO/IEC/IEEE 24774:2021, 3.11]

3.17

small and medium enterprise

SME

enterprise which employs fewer than 250 persons

[SOURCE: ISO/IEC 29110-1-2:2024, 3.92]

3.18

stakeholder

individual or organization having a right, share, claim, or interest in a *system* (3.19) or in its possession of characteristics that meet their needs and expectations

[SOURCE: ISO/IEC/IEEE 12207:2017, 3.1.59, modified — EXAMPLE and note 1 to entry have been removed.]

3.19

system

arrangement of parts or elements that together exhibit a stated behaviour or meaning that the individual constituents do not

Note 1 to entry: A system is sometimes considered as a product or as the services it provides.

Note 2 to entry: In practice, the interpretation of its meaning is frequently clarified by the use of an associative noun, e.g. aircraft system. Alternatively, the word "system" is substituted simply by a context-dependent synonym, e.g., aircraft, though this potentially obscures a system principles perspective.

Note 3 to entry: A complete system includes all of the associated equipment, facilities, material, computer programs, firmware, technical documentation, services and personnel required for operations and support to the degree necessary for self-sufficient use in its intended environment.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.46]

3.20

systems engineering management plan

SEMP

top level technical plan for managing the *systems* (3.19) engineering effort which defines how the technical aspects of the project will be organized, structured, and conducted and how the systems engineering processes will be controlled to provide a product that satisfies *stakeholder* (3.18) requirements

[SOURCE: ISO/IEC/IEEE 24748-4:2016, 4.14]

3.21

system-of-interest

SOI

system (3.19) whose life cycle is under consideration

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.48]

3.22

system structure

decomposition of a *system-of-interest* (3.21) into a set of interacting *systems* (3.19) and system elements

Note 1 to entry: The system structure is described in a system breakdown structure (SBS).

3.23

trade-off

decision-making actions that select from various requirements and alternative solutions on the basis of net benefit to the *stakeholders* (3.18)

3.24

user

individual or group that interacts with a *system* (3.19) or benefits from a system during its utilization

Note 1 to entry: The role of user and the role of *operator* (3.13) are sometimes vested, simultaneously or sequentially, in the same individual or organization.

[SOURCE: ISO/IEC/IEEE 15288:2023, 3.53]

3.25

work breakdown structure

WBS

deliverable-oriented hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables

Note 1 to entry: The WBS can be an output or an input.

[SOURCE: ISO/IEC/IEEE 26511:2018, 3.1.42, modified — The abbreviated term and note 1 to entry have been added.]

4 Conventions and abbreviated terms

4.1 General

Conventions for naming, diagramming, describing and defining profiles are defined in ISO/IEC 29110-2-1.

4.2 Naming, diagramming and definition conventions

The following process structure description and notation are used to describe the processes:

Process name – process identifier, followed by its abbreviation in parentheses “()”.

Process purpose – the high-level objectives and results expected of the effective implementation of the process. The implementation of the process should provide tangible benefits to the stakeholders.

Process outcomes – the process outcomes are identified by the abbreviation of the process name, followed by the letter “O” and a consecutive number, for example PM.01, SR.02.

Input work products – work products required to perform the process and its corresponding source, which can be another process or an external entity to the project, such as the acquirer. Input work products are identified by the abbreviation of the process name.

Output work products – work products generated by the process and its corresponding destination, which can be another process or an external entity to the project, such as an acquirer. Output work products are identified by the abbreviation of the process name.

Internal work products – work products generated (i.e. output work product) and consumed (i.e. input work product) by the process. Internal work products are identified by the abbreviation of the process name. An internal work product is not reviewed or approved by the customer.

All work products’ names begin with capital letters. Some work products have one or more states attached to the work product name surrounded by square brackets “[]” and separated by “,”. The work product state may change during the process execution. See [Clause 13](#) for the alphabetical listing of the work products, its descriptions, possible states and the source of the work product. The source can be another process or an external entity to the project, such as the acquirer.

Roles involved – names and abbreviation of the functions to be performed by project team members. Several roles may be performed by a single person and one role may be assumed by several persons. Roles are assigned to project participants based on the characteristics of the project. The role list is identified by the abbreviation of the process name and shown as a two-column table. See [Clause 12](#) for the alphabetical list of the roles and required competencies description.

Diagram – graphical representation of the processes. The large round-edged rectangles indicate process or activities, and the smaller square-edged rectangles indicate the work products. The directional or bidirectional thick arrows indicate the major flow of information between processes or activities. The thin directional arrows indicate the input or output work products. The notation used in the diagrams does not imply the use of any specific process life cycle.

Activity – a set of cohesive tasks. A task is a requirement, recommendation, or permissible action, intended to contribute to the achievement of one or more outcomes of a process. A process activity is the first level of process workflow decomposition and the second one is a task. Activities are identified by process name abbreviation followed by consecutive number and the activity name.

Activity description – each activity description is identified by the activity name and the list of related outcomes surrounded by parenthesis “()”. For example, PM.01 project planning (contributes to PM.01, PM.05, PM.06, and PM.07) means that the activity PM.01 project planning contributes to the achievement of the listed outcomes: PM.01, PM.05, PM.06 and PM.07. The activity description begins with the task summary and is followed by the task descriptions table.

Task description - Each task description begins with an active verb (e.g. assign, test) and is followed by an object (e.g. review the project plan). The task description doesn't impose any technique or method to perform it. The selection of the techniques or methods is left to the VSE or project team.

Tasks description tables contain four columns corresponding to:

- Role – the abbreviation of roles involved in the task execution.
- Task – description of the task to be performed. Each task is identified by activity ID and consecutive number, for example PM.01.01, PM.01.02, and so on. A few numbered items are added to provide additional information intended to assist the understanding or use of tasks.
- Input work products – work products needed to execute the task.
- Output work products – work products created or modified by the execution of the task.

NOTE 1 A conditional task is executed if its associated work product (e.g. software user documentation) is required by the customer and listed in the delivery instructions. A conditional task statement is preceded with this text: " x) Conditional task". A work product associated to a conditional task is identified as an 'optional' work product.

Organizational repository – list of work products to be saved in organizational repository; the configuration management strategy should be applied to some of them.

NOTE 2 Tables used in process description are for presentation purpose only. The tables are not prescribing a waterfall approach.

NOTE 3 The term 'Advanced' is using a capital 'A' to indicate an ISO/IEC 29110 profile (e.g. Advanced profile) while the term 'advanced' is used when referring to something modern and highly developed.

4.3 Notation used to document new processes, additions and modifications to the processes of the Intermediate profile

The Advanced profile has been designed to build upon the processes of the Intermediate profile such that, when moving from the Intermediate profile to the Advanced profile, a VSE should only add to its existing Intermediate profile processes the new processes (e.g., outcomes, activities, tasks, roles and work products) described in this document.

Since, in the Advanced profile, there are additions and modifications to the Intermediate profile processes, this document has been written such that it will be easy for a VSE to identify these additions and modifications. The project management (PM) and system definition and realization (SR) processes, of the Intermediate profile, have been complemented with additional outcomes, tasks and work products in a context where a VSE is conducting more than one project in parallel with more than one work team. The following notation is used to highlight the addition/deletion/modification to the Intermediate profile:

- added text:
 - is underlined;
 - except for the added new processes of the Advanced profile;
- deleted/modified text is struck out.

The Advanced profile has one new process that is not in the Intermediate profile: system transition and disposal process (SYTD).

The purpose of the system transition and disposal process is to move the system, in an orderly and planned manner, into the operational status. In this way, the system is functional and operable in the operational environment of the customer to end the existence of a system element or system for a specified intended use. At this time, the customer can appropriately handle, replace, or retire elements, by properly attending to critical disposal needs (e.g. per an agreement, per organizational policy, or for environmental, safety, security aspects).

The SYTD process is a conditional process. It is executed if a VSE is required, in the agreement (e.g. statement of work), to install and/or dispose of a system at the customer operational environment. If this is the case, this process is included in the scope of an audit or an assessment.

To facilitate the identification of additional abbreviations, roles and work products of the SYTD process of the Advanced profile, these items are underlined. To facilitate reading, the SYTD process has not been underlined.

The Advanced profile terminology has been aligned with ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 15289. The following terms of old standards have been replaced with the new terms:

- “Statement of work”, “agreement” and “contract” have been replaced with “agreement”;
- work products are identified with a unique code WP.XX where XX is a sequential number in [Clause 10](#). These codes have not been used in the descriptions of activities and tasks to facilitate readability.

4.4 Abbreviated terms

ACQ	acquirer
AM	acquisition management
CUS	customer
DES	designer
DEV	developper
PO	purchase order
PM	project management
PJM	project manager
PROM	proposal manager
SBS	system breakdown structure
SDD	system design document
SEMP	systems engineering management plan
SMART	specific, measurable, accepted, realistic and traced
SR	system definition and realization
STK	stakeholder
SUP	supplier
SW	software
SYS	systems engineer
<u>SYTD</u>	system transition and disposal
TM	technical management
TCM	technical manager

TPM	technical performance management
VSE	very small entity
V&V	verification and validation
V&VE	verification and validation engineer
WP	work product
WT	work team

5 Systems thinking

The traditional approach to solve a problem is called artisan. This approach focuses on dividing a problem into small parts and, once resolved each part is resolved, the whole problem is solved. This approach, however, has limitations because the insight of the whole system can be lost. To overcome this limitation, there is the systems thinking concept, which analyses and observes the system as a whole and identifies the interrelationships among the parts that compose it also with the system environment (e.g. enabling systems).

Systems thinking allows for a better understanding of the systems as a whole: Systems thinking is used to broaden the perspective to larger environments by considering the entire life cycle of the system and the different possible applications of the system. Systems can be immersed in different environments and multiple relationships will emerge. Every project has a context in which the system is embedded. Thus, a system is not only composed of software and hardware, but is always part of a larger operation, often involving people and other systems. The designer should clearly understand these relationships before defining a solution.

The “system” perspective enables the design of an optimized system to consider all needs and constraints. This perspective also helps to invent new solutions to meet existing needs or in some cases create new needs.

For this document, systems thinking should be considered when understanding the system to be designed so that, when identifying the requirements, all stakeholders’ needs are considered, as well as the context in which the system should operate. Following this approach, when deploying the requirements in smaller modules, it will help ensure effective integration of the parts.

6 Overview

This document provides the following processes: technical management, acquisition management, project management, systems definition and realization and system transition and disposal. These processes integrate tasks selected from ISO/IEC/IEEE 15288 and ISO/IEC/IEEE 15289. [Annex A](#) provides information about deployment packages (DPs) which will facilitate the implementation of these processes.

In the Entry, Basic, and Intermediate profiles of the generic profile group, the boundary between the VSE, its business environment, and its work product were naturally vague, since everyone was focused on one work product.

[Table 1](#) illustrates the four-stage systems engineering roadmap. The 1st column on the left lists the 2 processes of the ISO/IEC TR 29110-5-6-1 Entry profile. The list of processes of the Basic profile of the 2nd column is incrementally built from the left column, so that the processes for the 2nd column are all the ones from the Entry profile plus new tasks and new work products. The list of the processes of the Intermediate profile of the 3rd column is the process in the second column plus two new processes. The list of process of the Advanced profile of the 4th column is the process in the 3rd column plus one new process.

Table 1 — Systems engineering four-stage roadmap

ISO/IEC TR 29110-5-6-1 Entry profile	ISO/IEC TR 29110-5-6-2 Basic profile	ISO/IEC TR 29110-5-6-3 Intermediate profile	ISO/IEC 29110-5-6-4 Advanced profile
<ul style="list-style-type: none"> Software implementation Project management 	Processes of ISO/IEC TR 29110-5-6-1 with additional tasks and: <ul style="list-style-type: none"> Conditional process: Acquisition management 	Processes of ISO/IEC TR 29110-5-6-2 and: <ul style="list-style-type: none"> Technical management 	Processes of ISO/IEC TR 29110-5-6-3 and: <ul style="list-style-type: none"> Conditional process: Software transition and disposal process

With the Advanced profile, the VSE may have more than one project ongoing at a time. With the potential need for more workers, a difficult but necessary boundary should be defined. That boundary differentiates between what the VSE should do to survive in its business environment and what the VSE actors should do to fulfil the different agreements (engagement) undertaken by the VSE.

The purpose of the technical management (TM) process is to cover more business areas than those pertaining exclusively to the management of the individual projects and systems engineering. This includes the efforts required to define, design, produce, qualify, and deliver a project to the customer, thus assuring the continued operation of the VSE. Technical management identifies business opportunities that fit within the organizational goals and resources (e.g. human, knowledge and material) of the VSE. Technical management then consults with the subject matter experts, project management, and systems engineering resources, on the feasibility of the proposed opportunity by the VSE. The same is true with the proposed agreement, where the technical management will help ensure the feasibility and validity of the proposed agreement, arising from the interpretation of the request for proposal (RFP) or business opportunity. The result is the formal acceptance of the agreement into the project to help ensure the viability of the VSE (until then no official project exists).

The purpose of the project management (PM) process is to establish and carry out, in a systematic way, the tasks of the system definition and realization process, while conforming to the project's objectives for the expected quality, time, cost, and risks.

The purpose of the system definition and realization (SR) process is the systematic performance of the analysis, design, construction, integration, verification, and validation activities for a new or modified system, according to the specified requirements.

The purpose of the acquisition management (AM) process is to obtain work products (e.g. material, software), work services, or both, required by the VSE. The execution of the AM process is only required if a work product/service should be obtained from a supplier by the VSE, i.e. a conditional process.

The purpose of the system transition and disposal (SYTD) process is to move the system, in an orderly, planned manner, into the operational status such that the system is functional and operable in the customer's operational environment. At the end of the need or intended use of the system element or system, the appropriate replacement or disposal of the product will be properly attended to, to include any critical disposal needs (e.g. per an agreement, per organizational policy, or for environmental, safety, and security aspects).

The processes are interrelated (see [Figure 2](#)). The arrow connecting the AM and SYTD processes to the other processes and the process itself are dashed arrows to indicate that these 2 processes are conditional processes.

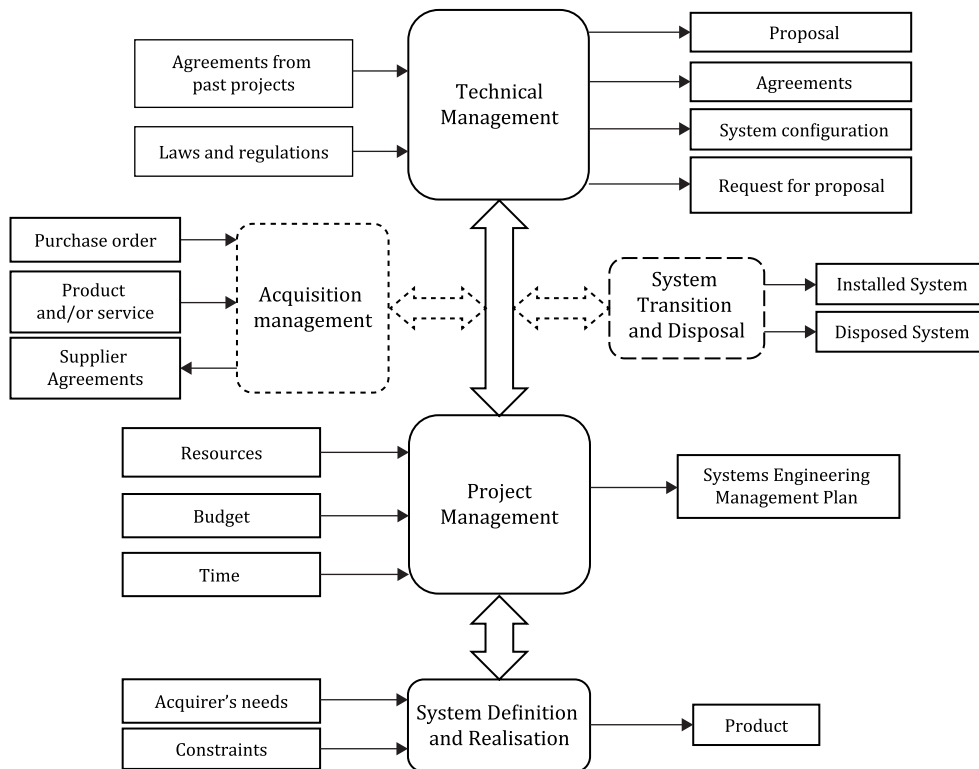


Figure 2 — Advanced profile processes

7 Technical management (TM) process

7.1 TM process purpose

The purpose of the technical management process is to identify opportunities, evaluate all in-place agreements or requests from customers for fit with organizational objectives and resources, obtain and provide the VSE with the necessary resources to perform all projects, monitor, and evaluate all projects, conduct lessons learned to improve the VSE, protect its intellectual property, and protect the security of its assets and information items.

This document is intended to be used by a VSE to establish processes to implement any development approach or methodology (e.g. agile, evolutionary, incremental, test-driven development) based on the VSE or project needs.

7.2 TM process outcomes

TM.01. Initiate and sustain suitable projects that fit with the organizational goals and resources (e.g. human, knowledge and material) to meet the business objectives of the VSE.

TM.02. Provide to the customer the work product that meets the agreed requirements.

TM.03. Provide the VSE with necessary human resources and to maintain their competencies, consistent with business needs.

TM.04. Provide an enabling infrastructure and services to all projects to support the VSE and the project objectives throughout the life cycle.

TM.05. Collect and analyse measures with VSE actors to internally disseminate the results as lessons and to institutionalise them as lessons learned for all projects.

TM.06. Protect the intellectual property and the security of the assets and information items of the VSE.

TM.07. Establish and maintain current an organizational repository, to capture, maintain history, and disseminate the projects' relevant documentation, including TM input and output work products.

TM.08. Provide structure for all projects evaluations, critiques and mentoring, if required, to deliver to the acquirer a system of defined quality, in time, and on cost.

7.3 TM roles involved

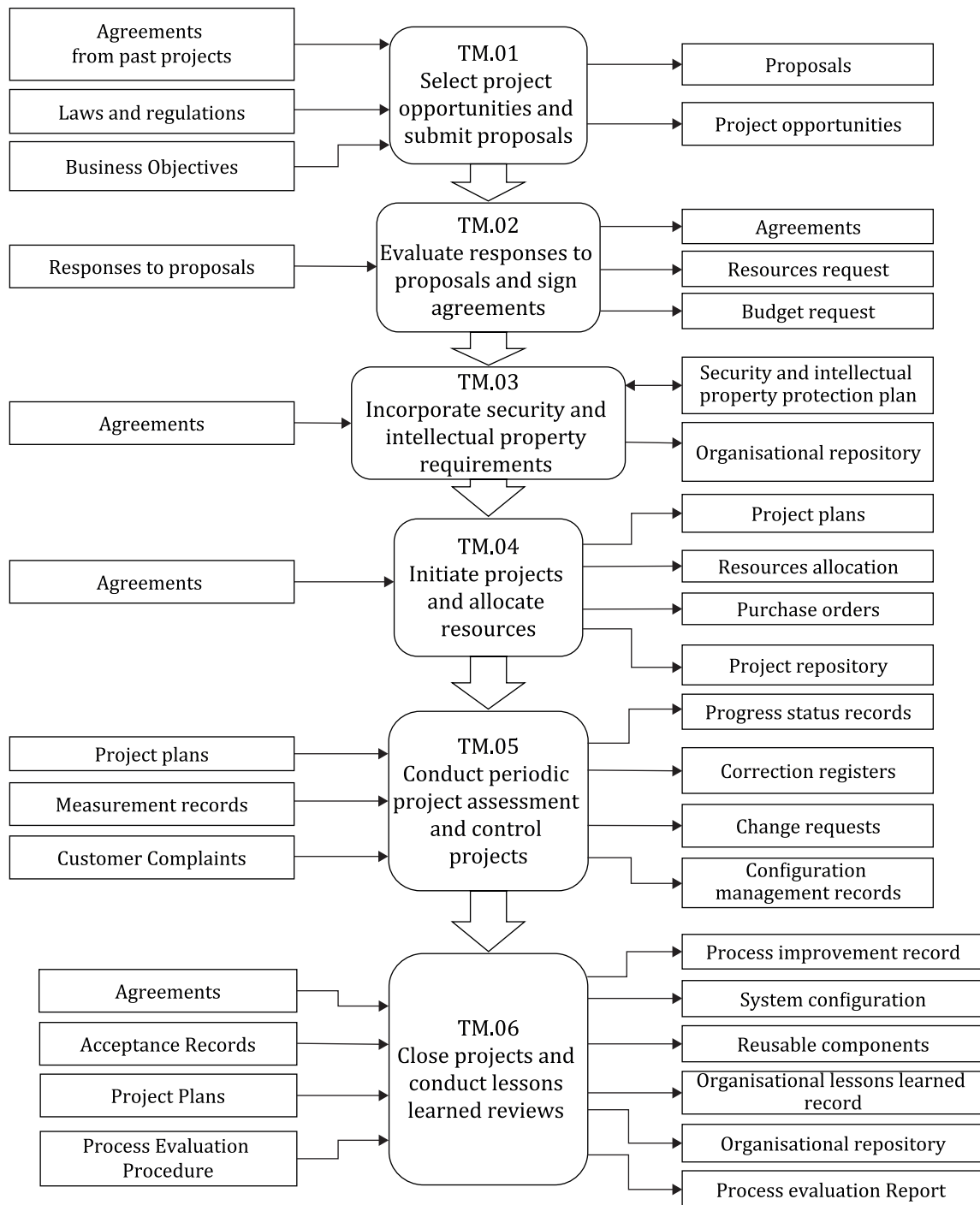
The roles involved in the TM process are:

- technical manager;
- project manager;
- customer.

7.4 TM process description

7.4.1 TM diagram

[Figure 3](#) shows the flow of information between the technical management process activities including the most relevant work products and their relationships.



NOTE 1 All the feedback lines are not all displayed to facilitate readability.

NOTE 2 A few input WPs have been produced by other processes (e.g. PM) during the execution of a specific project.

Figure 3 — Technical management process diagram

7.4.2 TM activities

7.4.2.1 General

The technical management process has the following activities.

- TM.01. Select project opportunities and submit proposals.

- TM.02. Evaluate responses to proposals and sign agreements.
- TM.03. Incorporate security and intellectual property requirements.
- TM.04. Initiate projects and allocate resources.
- TM.05. Conduct periodic project assessment and control projects.
- TM.06. Close projects and conduct lessons learned reviews and institutionalised them.

7.4.2.2 TM.01 Select project opportunities and submit proposals (contributes to TM.01)

This activity describes the tasks and information items needed to document project opportunities and proposals sent to potential customers.

The activity provides:

- project opportunities;
- proposals submitted to potential customers.

TM.01 task list is given in [Table 2](#).

Table 2 — TM.01 task list

Role	Task list	Input work products	Output work products
TCM PJMs	TM.01.01 Document project opportunities. 1) Agreements (e.g. contracts) from past projects can be used to document the project opportunities.	Business objectives [approved] Project opportunities [updated] Agreements [approved]	Project opportunities [initiated]
TCM PJMs	TM.01.02 Select project opportunities.	Project opportunities [updated] Request for proposal [published] Laws and regulations	Project opportunities [approved]
TCM PJMs SYS	TM.01.03 Prepare and approve proposals. 1) A proposal is prepared by a PJM during the execution of the AM process for a specific project. 2) Proposals can be developed using the proposal template in the work product description section of this document.	Project opportunities [approved] Proposal [received]	Proposal [approved]
TCM PJMs	TM.01.04 Submit proposals to potential customers.	Proposal [approved]	Proposal [submitted]

7.4.2.3 TM.02 Evaluate responses to proposals and sign agreements (contributes to TM.01)

This activity involves the evaluation of the responses to proposals submitted by customers, the negotiation and signature of agreements with customers. Once an agreement is signed, a project manager is assigned to the project and the project manager creates its project plan.

The activity provides:

- request for proposal(s);
- agreements.

TM.02 task list is given in [Table 3](#).

Table 3 — TM.02 task list

Role	Task list	Input work products	Output work products
TCM	TM.02.01 Evaluate all responses to proposals from potential customers and prepare agreements for the accepted proposals.	Proposals [submitted] Responses to proposals	Agreement [initiated]
TCM CUS	TM.02.02 Negotiate, finalize and sign all agreements with customers.	Agreement [initiated]	Agreement [signed]
TCM PJMs	TM.02.03 Approve projects and assign project managers to develop project plans and resources requests. 1) Project opportunities are updated (if applicable). 2) Project plans are developed according to the planning activity of the PM process.	Agreement [approved]	Project opportunities [updated]

7.4.2.4 TM.03 Incorporate security and intellectual property requirements (contributes to TM.06)

This activity documents the tasks and information items needed to develop and implement security of its assets and information items, and the protection of the intellectual property of the VSE.

The activity provides:

- security and intellectual property protection plan;
- organizational repository to store assets and information items securely.

TM.03 task list is given in [Table 4](#).

Table 4 — TM.03 task list

Role	Task list	Input work products	Output work products
TCM	TM.03.01 Develop a security and intellectual property protection plan. 1) The plan includes preventing infringements in the use of intellectual property of a third party and dealing with security issues of its assets and information.	Agreement [signed]	Security and intellectual property protection plan [initiated]
TCM PjMs	TM.03.02 Review and approve the security and intellectual property protection plan.	Security and intellectual property protection plan [initiated]	Security and intellectual property protection plan [approved]
TCM PjMs	TM.03.03 Implement the security and intellectual property protection plan.	Security and intellectual property protection plan [approved]	Security and intellectual property protection plan [implemented]
TCM	TM.03.04 Establish and maintain an organizational repository. 1) The repository should protect the security and intellectual property of the VSE and its customers.	Security and intellectual property protection plan [approved]	Organizational repository [established]

7.4.2.5 TM.04 Initiate projects and allocate resources (contributes to TM.03, TM.04, TM.07)

This activity is initiated with the approval of project plans and the resources requests. Human resources are allocated to projects. If work products or services should be acquired, purchase orders are approved. An organizational repository is established.

The activity provides:

- approved project plans;
- approved resources requests;
- approved purchased orders;
- human resource record.

TM.04 task list is given in [Table 5](#).

Table 5 — TM.04 task list

Role	Task List	Input work products	Output work products
TCM PJMs	TM.04.01 Review and approve all project plans, budget allocations and resource requests. 1) Assign required human resources and other resources to project (e.g. work team, computer facilities). 2) Human resource record is developed.	Agreements [approved] Project plans [initiated] Resources requests [initiated]	Project plans [approved] Resources requests [approved] Budget [approved] Human resource record [approved]
TCM PJMs	TM.04.02 Obtain resources and train project team members if needed.	Resources requests [approved] Human resource record [approved]	Resources obtained and trained Human resource record [updated]
TCM PJMs	TM.04.03 Decide if work products or services should be acquired from suppliers and/or services to be acquired. 1) If a work product or a service should be acquired, a purchase order is initiated. 2) If a work product (e.g. software component) or a service should be acquired from supplier(s), use the acquisition management process of this document.	Project plans [approved]	Purchase orders [initiated]
TCM PJMs	TM.04.04 Approve all purchase orders to obtain work products or services from suppliers. 1) Purchase orders are approved by the project plan execution activity of the PM process.	Purchase orders [initiated]	Purchase orders [approved]

7.4.2.6 TM.05. Conduct periodic project assessment and control projects (contributes to TM.02, TM.06)

This activity evaluates the performance of all the plans against documented commitments. The information items needed to perform this activity are the outputs of the project assessment and control activity of the PM process.

The activity provides:

- progress status record;
- correction register;
- change request.

TM.05 task list is given in [Table 6](#).

Table 6 — TM.05 task list

Role	Task list	Input work products	Output work products
TCM PJMs	TM.05.01 Evaluate all projects progress with respect to the project plans, comparing: <ul style="list-style-type: none"> — actual tasks against planned tasks; — actual results against established project objectives; — actual resource allocation against planned resources; — actual cost against budget estimates; — actual time against planned schedule; — actual risk against previously identified; — Identify deficiency in knowledge or training. 	Project plans [approved] Customer complaints [published]	Progress status records [evaluated]
TCM PJMs	TM.05.02 Establish actions to correct deviations or problems and identified risks. 1) Concerning the accomplishment of the plan, as needed, document them in correction register and track them to closure.	Progress status records [evaluated]	Correction register [initial]
TCM PJMs	TM.05.03 Identify changes to requirements or project plans or both. 1) To address major deviations, potential risks or problems concerning the accomplishment of the plan, document them in change requests and track them to closure.	Progress status records [evaluated]	Change requests [initiated]
TCM	TM.05.04 Record and report the status of the items and modifications.	Configuration management strategy [initiated]	Configuration management records [initiated]

7.4.2.7 TM.06. Close projects and conduct lessons learned reviews (contributes to TM.01, TM.05)

This activity formalizes, at the organizational level, the project closure activity of the PM process, by delivering the work products to the customers. organizational lessons learned reviews are performed using the output of the project closure activity of the PM process. Process improvement opportunities are documented, implemented, and reusable components are identified and stored in the organizational repository.

The activity provides:

- acceptance record;
- delivery instructions signed by customer;
- product;
- organizational lessons learned;
- process improvement record;
- reusable components;
- updated organizational repository.

TM.06 task list is given in [Table 7](#).

Table 7 — TM.06 task list

Role	Task list	Input work products	Output work products
TCM PJMs CUS	<p>TM.06.01 Formalize the completion of the projects according to the delivery instructions.</p> <p>1) As established in the project plans, providing acceptance support and getting the acceptance record signed from the customers.</p> <p>2) The delivery instructions have been produced by the PM process of a specific project. The document is used as an input, no changes are done to this WP.</p>	<p>Agreements [approved]</p> <p>Acceptance records [initiated]</p> <p>Delivery instructions [signed]</p> <p>Product [delivered internally]</p>	<p>Acceptance records [signed]</p> <p>Delivery instructions [signed]</p> <p>Product [accepted]</p>
TCM PJMs	<p>TM.06.02 Perform the evaluation of processes.</p> <p>1) The processes of the VSE are evaluated to identify weaknesses and propose improvements.</p>	<p>Process evaluation procedure [approved]</p>	<p>Process evaluation record [published]</p>
TCM PJMs	<p>TM.06.03 Conduct a lesson learned review of all projects.</p> <p>1) Lessons learned are analysed to identify improvements to processes, work products, and prioritise them in the improvement record.</p> <p>2) The business objectives are updated if necessary.</p> <p>3) A few input WPs (e.g., meeting records) have been produced during the execution of a project.</p>	<p>Agreements [approved]</p> <p>Business objectives [approved]</p> <p>Project plans [approved]</p> <p>Meeting records [published]</p> <p>Customer complaints [published]</p> <p>Project lessons learned record [approved]</p> <p>Measurement records [published]</p>	<p>Organizational lessons learned record [approved]</p> <p>Process improvement record [approved]</p> <p>Business objectives [updated]</p>
TCM PJMs	<p>TM.06.04 Implement selected improvements.</p>	<p>Process improvement record [approved]</p>	<p>Process improvement record [implemented]</p>
TCM PJM	<p>TM.06.05 Identify reusable components from project repositories and store them in the organizational repository.</p>	<p>Product [accepted]</p> <p>Project repositories [baselined]</p>	<p>Organizational repository [updated]</p> <p>— Reusable components</p>
TCM PJM	<p>TM.06.06 Update the organizational repository.</p>	<p>Product [accepted]</p> <p>Project repositories [baselined]</p>	<p>Organizational repository [updated]</p>

7.4.2.8 Incorporation to the organizational repository

The work products to be saved in organizational repository are:

- organizational objectives;
- project opportunities;
- proposal;

- agreement;
- project plan;
- acceptance record;
- security and intellectual property protection plan;
- organizational lessons learned record;
- process improvement record;
- meeting record;
- purchase order;
- reusable components;
- resource request;
- human resource record.

8 Project management (PM) process

8.1 PM process purpose

The purpose of the project management process is to establish and carry out, in a systematic way, the tasks of the system definition and realization project. This supports compliance with the project's objectives in the expected quality, time, and cost, within the acceptable risks.

The PM process of the Basic profile has been complemented with additional objectives, tasks, and work products in a context where a VSE is conducting more than one project with more than one work team. In addition, new tasks have been added to the PM process of the Basic profile to improve the management of projects. It also carries out administrative tasks relating to the storage, handling, protection and delivery of work products and configuration items.

This document is intended to be used by the VSE to establish processes to implement any development approach or methodology (agile, evolutionary, incremental, test-driven development, etc.) based on the VSE or project needs.

8.2 PM process outcomes

PM.01. The project plan, the approved VSE proposal and commitments, are reviewed and accepted by both the acquirer, the organizational management, and the project manager. The tasks and resources necessary to complete the work are sized and estimated.

PM.02. Progress of the project is monitored against the project plan and recorded in the progress status record. Corrections to remediate problems and deviations from the plan are made when project targets are not achieved. Closure of the project is achieved when the acquirer acceptance documented in the product acceptance record is completed. The system is disposed of in accordance with the agreement.

PM.03. Change requests are addressed when submitted. Changes to system requirements are analysed and evaluated by the project team for cost, schedule, risks, and technical impacts.

PM.04. Review meetings with the work team, the acquirer, and suppliers are held. Reviews of work products of activities are conducted, and the agreements are registered and tracked.

PM.05. A risk management approach is developed. Risks are identified, analysed, prioritized, and monitored as they develop during the conduct of the project. Resources to manage the risks are determined.