TECHNICAL REPORT

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Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 2-2: Guide for the development of domain-specific profiles

Ingénierie des systèmes et du logiciel — Profils de cycle de vie pour très petits organismes (TPO) —

Partie 2-2: Guide de préparation de profils spécifiques à un domaine

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Foreword

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

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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

The full list of parts of ISO/IEC 29110 is available here.

Introduction

Very Small Entities (VSEs) around the world are creating valuable products and services. For the purpose of ISO/IEC 29110, a Very Small Entity (VSE) is an enterprise, an organization, a department or a project having up to 25 people. Since many VSEs develop and/or maintain system and software components used in systems, either as independent products or incorporated in larger systems, a recognition of VSEs as suppliers of high-quality products is required.

According to the Organization for Economic Cooperation and Development (OECD) SME and Entrepreneurship Outlook report (2005) "Small and Medium Enterprises (SMEs) constitute the dominant form of business organization in all countries worldwide, accounting for over 95 % and up to 99 % of the business population depending on country". The challenge facing governments and economies 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 conformance 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 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 guides has been developed based on a set of VSE characteristics. The guides 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 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 ISO/IEC 29110 specifications.

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

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

The ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality and process performance. See Table 1.

Table 1 — ISO/IEC 29110 target audience

ISO/IEC 29110	Title	Target audience
ISO/IEC 29110-1	Overview	VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-2	Framework for profile preparation	Profile producers, tool vendors and methodology vendors. Not intended for VSEs.
ISO/IEC 29110-3	Certification and Assessment guidance	VSEs and their customers, assessors, accreditation bodies.
ISO/IEC 29110-4	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-5	Management, engineering and service delivery guides	VSEs and their customers.
ISO/IEC 29110-6	Management and engineering guides not tied to a specific profile	VSEs and their customers.

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

ISO/IEC TR 29110-1 defines the terms common to the set of ISO/IEC 29110 series. It introduces processes, lifecycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. It also introduces the characteristics and needs of a VSE and clarifies the rationale for specific profiles, documents, standards and guides.

ISO/IEC 29110-2-1 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, conformance, 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 29110-3 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, e.g. 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 29110-4-m provides the specification for all profiles in one profile group that are based on subsets of appropriate standards elements.

ISO/IEC TR 29110-5-m-n provides management, engineering and service delivery guides for the profiles in a profile group.

The future ISO/IEC TR 29110-6-x provides management and engineering guides not tied to a specific profile.

This part of ISO/IEC 29110 provides to any domain-specific group the guidance for developing a profile which is domain-specific to business situation of specific kind of VSEs. It may also be used by technical advisers including consultants to VSEs on software process problems. It also enhances a conceptual framework for standardized profile developers using the ISO/IEC 29110 series concept.

Figure 1 describes the International Standards (IS) and Technical Reports (TR) and positions the parts within the framework of reference. Overview, assessment guide, management and engineering guide

are available from ISO as freely available Technical Reports (TR). The Framework document, profile specifications and certification schemes are published as International Standards (IS).

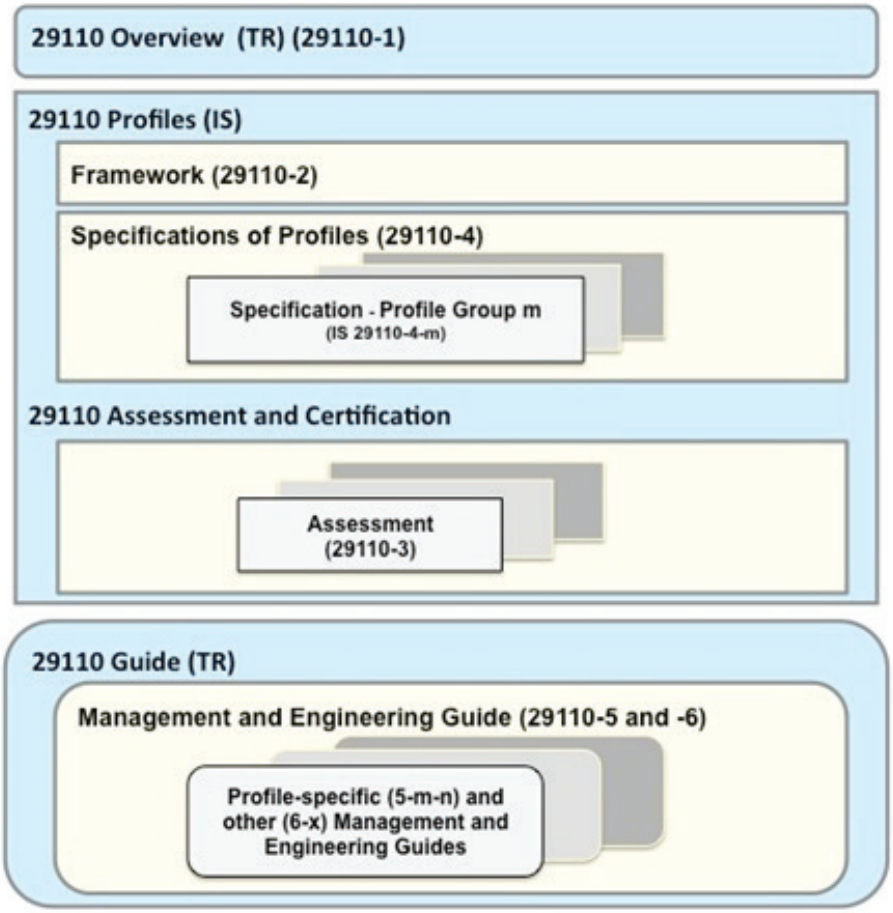


Figure 1 — ISO/IEC 29110 series

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 2-2: Guide for the development of domain-specific profiles

1 Scope

This part of ISO/IEC 29110 provides a guide for developing a profile which is domain-specific for VSEs (Very Small Entities) business situation. It may be used by technical advisers, including consultants, to help VSEs on software process problems. It also provides a conceptual framework for standardized profile developers using the ISO/IEC 29110 series concept.

2 Normative references

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

ISO/IEC 29110-2-1, *Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —Part 2: Framework and taxonomy*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29110-2-1 apply.

4 Abbreviations

VSE Very Small Entity

QCD Quality, Cost and Delivery

UML Unified Modelling Language

5 Overview of a domain-specific VSE profile

5.1 Preparation of a domain-specific VSE profile

The purpose of a domain-specific VSE profile is to define a subset of processes and product requirements for systems or software engineering. International Standards, such as ISO/IEC/IEEE 15288, ISO/IEC 12207, ISO/IEC/IEEE 15289 and others provide the base information for the development of the profile.

The preparation of a domain-specific VSE profile includes the following steps.

a) Determine VSE characteristics related to: finance, resources, internal business processes, target application domain characteristics and position in the supply chain.

b) Identify VSE needs, suggested knowledge and competencies derived from business and/or social practices and/or conventions and various regulation requirements.

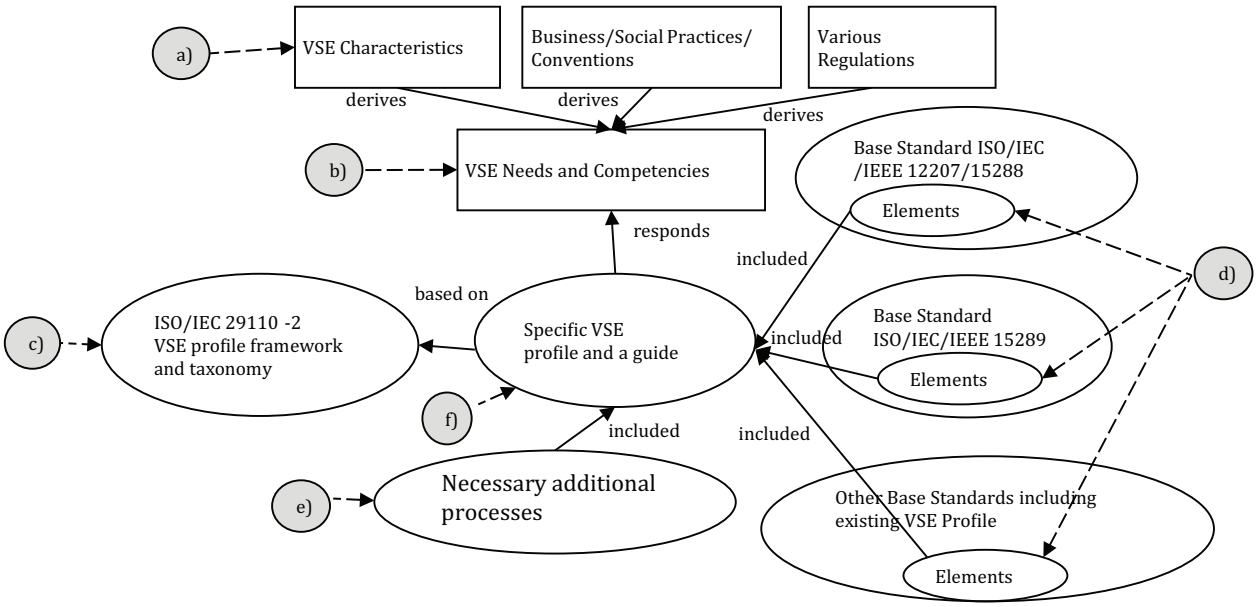
c) Specify domain-specific VSE profile elements required to respond to the VSE's needs and suggested competencies according to ISO/IEC 29110-2-1.

d) Select and link to the subset of specific VSE profile elements that map to the ISO/IEC/IEEE 15288, ISO/IEC 12207 processes or other appropriate domain specific process standard and to the subset of specific VSE product elements that map to the ISO/IEC/IEEE 15289 product elements or other appropriate domain specific work product standard.

e) Identify and specify other process and product elements.

f) Define a domain-specific VSE profile and/or its Management and Engineering Guide.

Figure 2 illustrates the steps to prepare a domain-specific VSE profile.



Key

rectangles	VSE situational elements
ellipses	standards or subsets of their elements
solid arrow	labeled relationships
circles with dashed arrows	reference to preparation steps

Figure 2 — Domain-specific VSE Profile preparation

A profile can be built not only from standards but also from a standardized profile. For example, a domain-specific profile could be built using the ISO/IEC 29110 Basic Profile and adding necessary processes following procedures introduced in Clause 7 and Clause 8.

A domain-specific profile may be defined by an organization other than a de-jure standardization organization. In such a case, the domain-specific profile is not a standardized profile in accordance with the ISO/IEC TR 10000-1 definition and the ISO/IEC 29110-2-1 definition.

5.2 Implementation of a domain-specific VSE profile

To implement a domain-specific VSE profile, a typical contract or agreement should be identified. This may be based on the customer and/or market requirements and/or regulations, supplemented by the business practices and/or conventions. Business practices and/or conventions are sometimes used to avoid the detailed requirement, but such an assumption should be clarified.

A VSE system or software development project follows the domain-specific VSE profile to fulfil the statement of work and to generate the products. A VSE can perform other activities to support the project, as required.

Figure 3 illustrates the context of the implementation rationale for a domain-specific VSE profile.

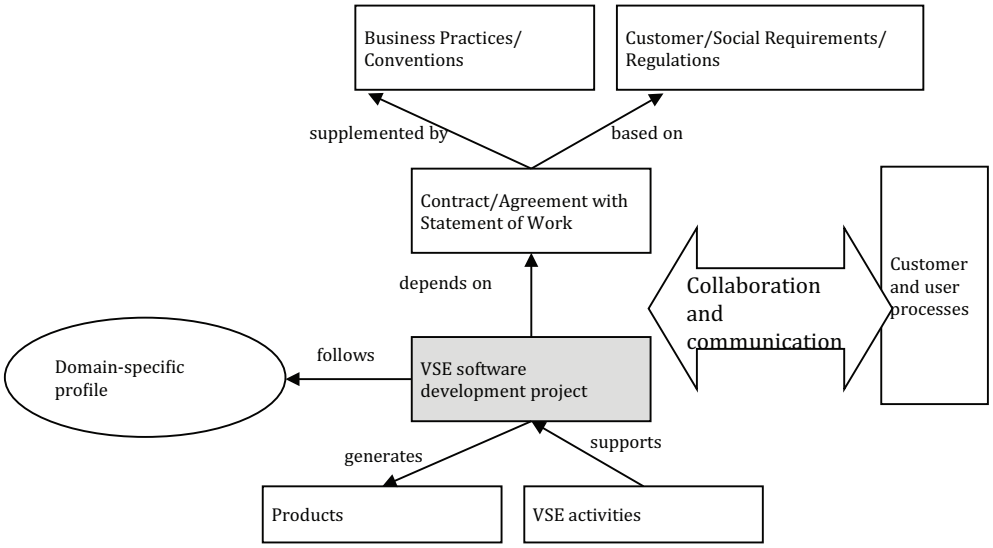


Figure 3 — Context of the implementation rationale for a domain-specific VSE profile

The notation of Figure 3 is similar to the notation of Figure 2.

5.3 VSE profile in a supply chain and operational environments

A software and/or system supplied to users are sometimes an output from a supply chain, i.e. a series of suppliers contributing to final products. The software and software intensive IT system is valuable while used and their criticality or integrity levels are defined based on the environment and context in which they are used. Stakeholders in a software and/or system supply chain should share necessary processes and/or practices to support software and/or system criticality or integrity levels. The VSE roles and responsibilities depend on their backgrounds.

A software and software intensive IT system sometimes has a wide range of influence on users, consumers and the public while in use. The consumer and public viewpoint should be considered when risks are analysed for software/system use. This consideration should also cover any environmental change impact of the systems usage.

Figure 4 shows the relationship between risk/integrity recognition and a domain-specific VSE profile.

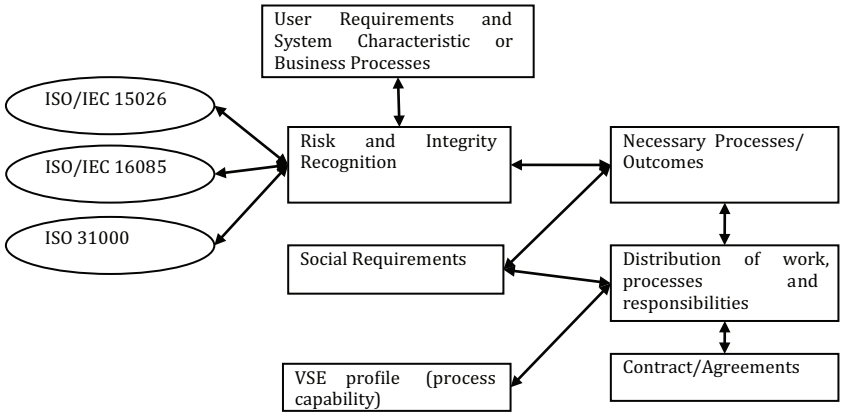


Figure 4 — Risk and/or integrity recognition for a domain-specific VSE profile

6 Background factors to identify a new domain-specific profile

6.1 User view for process purposes

A software or a system is expected to be dependable throughout its whole lifecycle by customers, end-user, and society. The user expects that the developer's lifecycle processes are complete and accurate for delivery of a dependable software/system.

Quality aspects of industrial processes are characterized to include quality, cost, and delivery (QCD). In addition, safety, security, and usability requirements are emphasized as important factors along with system functionality and benefits. Sometimes one software program and/or system is connected with another software program and/or system on a network. Some software program works with hardware components, such as control devices, so, in many situations, fully inter-operable and dependable software is required.

Operational mistakes often result from insufficient usability and integrity of software and IT systems. Systems and software used in an organization should support business continuity and sustainability of the organization. Based on this, system and/or software developed by VSEs should have the appropriate dependable quality characteristics from the user's point of view.

In addition, industrial software and/or system development should provide a dependable product with a reasonable cost and delivery schedule. That means integrity recognition is needed for a profile development.

A VSE should fulfil such expectations through its organizational activities and system and/or software processes. A domain-specific VSE profile should be developed to meet such expectations.

6.2 Contract and distribution of processes

A VSE usually works under an agreement or a contract with the acquirer. The contract should define a statement of work (SOW) for the VSE. The SOW should show explicitly, or implicitly in an appropriate case, the processes that the VSE should perform for that contract to fulfil and processes performed by the acquirer. From the user point of view, every necessary process should be distributed between the

acquirer, supplier, or other stakeholders in a consistent set of documents. To support this, it may be useful to read ISO/IEC 12207:2008, 6.1.1.3.1, 6.1.1.3.4 and 6.1.2.3.4 on acquisition process/practices.

6.1.1.3.1 Acquisition preparation. This activity consists of the following tasks:

6.1.1.3.1.11 The acquirer should determine which processes of this International Standard are appropriate for the acquisition and specify any acquirer requirements for tailoring those processes. The acquirer should specify if any of the processes are to be performed by parties other than the supplier, so that suppliers may, in their proposals, define their approach to supporting the work of other parties. The acquirer shall define the scope of those tasks that reference the contract.

6.1.1.3.1.12 The acquisition documentation shall also define the contract milestones at which the supplier's progress shall be reviewed and audited as part of monitoring the acquisition (see 7.2.6 and 7.2.7).

6.1.1.3.4 Contract agreement. This activity consists of the following tasks:

6.1.1.3.4.1 The acquirer may involve other parties, including potential suppliers or any necessary third parties (such as regulators), before contract award, in determining the acquirer's requirements for tailoring of this International Standard for the project. In making this determination, the acquirer shall consider the effect of the tailoring requirements upon the supplier's organisationally-adopted processes. The acquirer shall include or reference the tailoring requirements in the contract.

[ISO/IEC 12207:2008]

6.1.2.3.4 Contract execution. This activity consists of the following tasks:

6.1.2.3.4.1 The supplier shall conduct a review of the acquisition requirements to define the framework for managing and assuring the project and for assuring the quality of the deliverable software product or service.

6.1.2.3.4.2 If not stipulated in the contract, the supplier shall define or select a life cycle model appropriate to the scope, magnitude, and complexity of the project. The life cycle model shall be comprised of stages and the purpose and outcomes of each stage. The processes, activities, and tasks of this International Standard shall be selected and mapped onto the life cycle model.

NOTE Ideally, this is performed by using an organisationally-defined life cycle model.

[ISO/IEC 12207:2008]

In a software/system supply chain, a VSE may have a contract with a system integrator. The system integrator has software or system lifecycle processes for their own activities and may also have acquisition-related processes for collaboration with the VSE. System or software users also have acquisition-related processes along with requirement-related processes and operation-related processes. They may distribute and share these software processes with the VSE. Users are sometimes not familiar with systems/software technology and system and/or software processes. In this case, a VSE or consultant can provide proposals to the users addressing the use of the processes.

6.3 Contract and distribution of responsibilities

The distribution and/or sharing of process with related parties can be sometimes described in a contract as parts of the responsibility statement.

The contract should define the agreements, including

a) responsibility to perform the identified and necessary processes,

b) objects and methods for collaboration and communication,

c) deliverables and their release timing,

d) responsibility of acceptance tests and maintenance,

e) overall assurance and/or warranty, including

   1) related to verification and validation, and

   2) related to responsibility for Product-Liability assurance,

f) control of information, including

   1) confidential information, including disclosure agreement establishment

   2) personal information,

   3) security management concerning deliverable software,

   4) due care of overall project information, and

g) control of intellectual rights, including

   1) property right, copyright, patent right, reuse right, and backup right,

   2) intellectual rights responsibility on third party software usage, and

   3) intellectual rights responsibility on free or open source software usage.

NOTE Reuse rights significantly affect VSE's processes, since effective processes may include many aspects of reuse strategy for analysis, design, code, test and others.

6.4 Competency of suppliers

A VSE may be competent in some application and engineering process relating to some domains. Such competencies may contribute to an enhanced process capability for, for example, requirement engineering. The specific application domain may have some specific business convention that the VSE's competency supports. The competency may relate to a specific domain engineering or a specific system/software technology. All VSEs have different characteristics. Some VSEs specialize in a specific technical skills where they provide specific skills to end-users or other stakeholders. Their system/software process may be centralized to specific processes, thus other processes should be provided by other stakeholders. For example, IV and V (independent verification and validation) suppliers provide verification and validation processes, and audit suppliers provide audit processes. Test processes may be provided by a security test provider, usability test provider, and other test service providers.

Members of a large system integration team may include VSEs. Networking and network security components may be provided by a network integrator VSE. A Cloud service provider VSE may provide the development environments and configuration management services. Some other services may be provided by consultants, multi-vendor system coordinators, or a system integrator VSE.

A VSE's competency is influenced by cultural factors and/or local business conventions within global perspective. It may also be influenced by local regulations and guidelines for business areas which are targeted by a VSE. Continuing business relationship between suppliers and acquirers will also influence VSE practices. Sometimes a VSE's role is not clearly defined in accordance with local business conventions or local cultural common sense. System integrators may have their own system processes, software processes and acquisition processes that provide interface to processes with a VSE. The VSE's competency may be related to such system integrators requirements.

Theoretically, a VSE has the knowledge to make similar system/software in a repeatable manner and the ability to reuse system/software components. Legal regulations may force limitations to such

possibilities based on copyright regulations, patent regulations, and/or security regulations. Contracts between suppliers and acquirers should clarify how to resolve such issues. Some development teams may supply a series of system/software under different corporate brands. In such a case, the users' reliance on this system/software may relate to that team's competency and not to the corporate competency.

Organizational competency, team competency and personal competency have different characteristics, but depend on each other. Some VSEs have highly competent personnel with good communications skills and a good understanding of the requirements. They may not need a management-oriented separate process, like some newly established VSEs may, to define management process rules to help inexperienced and new personnel.

6.5 Interface problem and integrating process

Suppliers and acquirers should collaborate to establish interface definitions to divide the work and retain the integrity of the total system, including human interfaces. Communication and collaboration without misunderstanding and ambiguity between suppliers and acquirers is very important for successful system/software development and a sound system/software lifecycle.

Sometimes divided work requires the consideration of additional integrating processes/practices and integrating cost. Negotiations on such additional processes and/or practices with their associated *c*ost should be performed by the contractual parties. To support this, it may be useful to read ISO/IEC 12207:2008, 6.1.1.3.5, 6.1.1.3.6 and 6.1.2.3.4 on acquisition process/practices.

6.1.1.3.5 Agreement monitoring. This activity consists of the following tasks:

6.1.1.3.5.1 The acquirer shall monitor the supplier's activities in accordance with the Software Review Process (7.2.6) and the Software Audit Process (7.2.7). The acquirer should supplement the monitoring with the Software Verification Process (7.2.4) and the Software Validation Process (7.2.5), as needed.

6.1.1.3.5.2 The acquirer shall cooperate with the supplier to provide all necessary information in a timely manner and resolve all pending items.

6.1.1.3.6 Acquirer acceptance. This activity consists of the following tasks:

6.1.1.3.6.1 The acquirer should prepare for acceptance based on the defined acceptance strategy and criteria. The preparation of test cases, test data, test procedures, and test environment should be included. The extent of supplier involvement should be defined.

6.1.1.3.6.2 The acquirer shall conduct acceptance review and acceptance testing of the deliverable software product or service and shall accept it from the supplier when all acceptance conditions are satisfied. The acceptance procedure should comply with the provisions of 6.1.1.3.1.9.

6.1.1.3.6.3 After acceptance, the acquirer should take the responsibility for the configuration management of the delivered software product (see 7.2.2).

NOTE The acquirer may install the software product or perform the software service in accordance with instructions defined by the supplier.

6.1.2.3.4 Contract execution. This activity consists of the following tasks:

6.1.2.3.4.1 The supplier shall conduct a review of the acquisition requirements to define the framework for managing and assuring the project and for assuring the quality of the deliverable software product or service.

[ISO/IEC 12207:2008]

6.6 Application domain and business convention

The application domain that a VSE engages in may require that the VSE processes include additional activities or result in additional outcomes. For such cases, the VSE should have additional processes and/or practices to meet these constraints.

In addition, domain specific practices/conventions or local business practices/conventions may require some additional processes/practices, and may eliminate some processes and/or practices.

6.7 Other situational factors affecting development of a VSE profile for a specific domain

Other situational factors that possibly affect the development of a VSE profile for a specific domain are provided in Annex B.

7 Identifying VSE processes

7.1 Selection approach

A specific domain community may identify their domain-specific VSE profile. Their approach to identify the profile may include integrity, project size, their own process capability, contractual situation, and external resources to complement their capability.

Typically, profiling of processes and/or practices may include

a) merger of processes/practices: Related processes and/or practices are combined and simplified into one process,

b) split of processes and/or practices: Necessary practices, activities, tasks are re-grouped into a different process and/or practice. Sometimes a merger and split are combined, and N:M mapping may be adopted,

c) non-adoption of processes and/or practices: After some considerations, e.g. project integrity level, project size, and contractual situation, some processes and/or practices are identified as not necessary, and

d) addition of processes and/or practices: After some considerations, e.g. project integrity level, project size, and contractual situation, some additional processes/practices are identified as necessary.

Profiling of processes may be performed to make a domain-specific VSE profile for a specific organization or group of organizations. It may be performed also during the preparation stage of a project.

7.2 Factors that should be considered in the profile development procedure

7.2.1 System integrity level

The definition or selection of a VSE profile should consider the project integrity level for the specific domain.

Integrity level recognition of the target system/software or project, may require a strict or simplified process and/or practice. The consequence of such a consideration may lead to a rigid process definition and assured process performance, or a simplified process definition and as-is performance.

For simplification, multiple processes and/or practices may be combined into one or more processes and/or practices. Some management processes and/or practices may be eliminated because the combined processes may not require management overhead.

For rigid and assured process implementation, one process and/or practice may be divided into multiple processes and/or practices. Additional management processes may be added to manage the additional process resources.

7.2.2 Project size, complexity, novelty, product lifetime, and/or reuse conventions

The definition or selection of a VSE profile should consider the typical or specific project size, complexity, novelty, product lifetime, and/or reuse conventions.

Large projects require explicit management processes and/or practices, while small projects may require implicit performance of such processes and/or practices. In such cases, the VSE incorporates some management processes and/or practices to the related processes and/or practices as required.

7.2.3 Adding processes and/or practices

The definition or selection of a VSE profile should consider the need for additional processes and/or practices.

For a particular domain, additional system/software processes and/or practices may be added to match the domain-specific requirements.

For a particular consideration, such as safety, security, privacy, usability, availability, industrial regulation, or cultural convention, there may be a requirement for additional processes and/or practices.

Professional knowledge and decisions may be important for such consideration. Appropriate consensus for these decisions should be established.

7.2.4 VSE competency

The definition or selection of a VSE profile should consider the VSE's specific competency.

A VSE may be competent in some application domains that are dependent on certain business conventions. Its projects may have similar integrity levels and similar additional considerations. In such cases, it can define its typical requirements for processes.

A VSE may have its own technical competency and related facilities, including information databases, system/software and/or hardware development environments, network and/or system infrastructure, organizational management, team management, and skilled personnel. Such factors may influence process and/or practice choice.

7.2.5 Contractual situation

Suppliers, acquirers and other stakeholders share processes, thus their responsibilities should be clarified in contractual agreements.

Such agreements should consider the following factors:

a) integrity of target system based on risk recognition;

b) additional requirements for processes and/or practices in the application domain and by local regulations;

c) distribution of processes and/or practices and responsibilities;

d) interface communications and additional interface processes and/or practices.

7.2.6 Effective use of external resources and support tools

Sometimes VSE's resources may be limited and external services may be effectively used. Various process-related consultants, specific process service providers, process support tool providers, educational and/or training service providers, and various public VSE support service agencies may be included in such external resources.

A VSE may choose to use open source system/software engineering tools as process support facilities. Refer to Annex C for this purpose.

A VSE should evaluate the benefits of using external resources. The use of external resources could impact the distribution of processes and/or practices and responsibilities.

7.2.7 Other factors

Many factors should be considered when identifying processes. Such consideration may include the following factors other than those mentioned in preceding subclauses:

a) stability of, and variety in, operational environments;

b) risks, cost or performance that are a concern for interested parties;

c) starting date and duration of utilization;

d) emerging technology opportunities;

e) availability of the services of enabling systems;

f) roles and responsibilities in the overall life cycle of the system;

g) need to conform to other standards;

h) legal, cultural or industry regulation and/or conventions.

7.2.8 Impacts of factor consideration and rationales

The above-mentioned factors will provide the rationale to identify each VSE profile element. For a domain-specific VSE profile definition, the following items should be considered (necessary or unnecessary):

a) criticality or integrity level of safety, security, usability, availability (see 7.2.1);

b) project size, complexity novelty, product lifetime, and/or reuse conventions (see 7.2.2);

c) domain-specific requirements (see 7.2.3);

d) limitation of applicable resources and/or competencies (see 7.2.4);

e) agreement, contract, or contractual convention (see 7.2.5);

f) external service usage (see 7.2.6);

g) legal, cultural, or industry regulations and/or conventions (see 7.2.7).

For a domain-specific VSE project profile, the following items should be considered:

a) necessary distribution of processes and/or practices and distribution of responsibilities explicitly defined in the contract and/or agreement (see 7.2.5);

b) risk analysis or integrity level recognition defined(see 7.2.1).

7.2.9 Expression of rationales

The rationale for identification of each profile element should be expressed clearly in the profile definition to avoid any confusion and to clarify background considerations.

Expression of rationale may be used as an abbreviated label, such as CONTRACT-CONVENTION.

7.3 Examples for a profile preparation consideration

Examples for a profile preparation consideration are shown in Annex A.

8 Developing the profile description

Based on considerations of process needs for a new VSE profile, the profile developer should build a solid profile description according to requirements of ISO/IEC 29110-2-1. Procedures for developing a profile are described in multiple clauses of ISO/IEC 29110-2-1. Examples of how to develop a profile description are described in ISO/IEC 29110-4-1 or ISO/IEC 29110-4-6.

An illustration of the typical development steps is shown in the Figure 5.

For developing a new profile, a developer may use an existing profile instead of an existing International Standard. In such a case, the selection of processes, process-related elements, and products should be from that profile. The corresponding tables between the new profile and the International Standard may be replaced by the new profile and the existing profile with some additions from the International Standard. See Annex D for simplified corresponding tables.

The new profile definition may be accompanied by the corresponding engineering and management guides. These guides should describe the necessary processes, outcomes, work products and activities and tasks using simple descriptions.

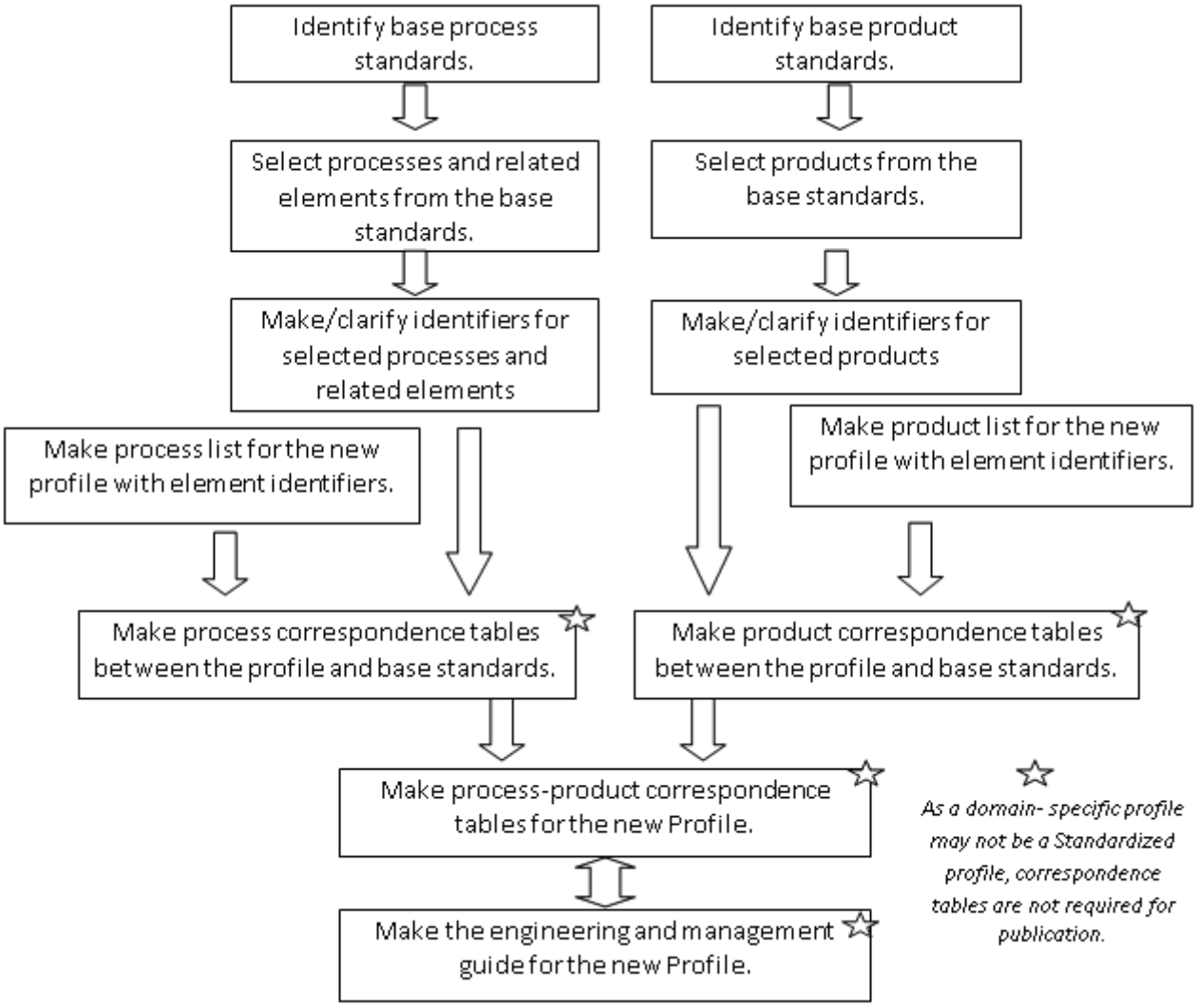


Figure 5 — Illustration of the typical profile development

9 Self-defined profile and self-declaration of conformance

A domain-specific group of VSEs can define its own self-defined profile. Such profiles can be made using the guidelines shown in this part of ISO/IEC 29110. Informative guidance is provided in Annex A to describe such a profile.

The self-defined profile, developed by a group of VSEs, may be accompanied by a criteria for conformance to that profile. Therefore, it may be used for the basis of a conformance assessment.

Annex A
(informative)

Example for a profile preparation consideration

A.1 General

An overview for developing a profile for a critical system is shown and an example for Generic Profile Group development is also shown.

A.2 Example for a critical system/software

A.2.1 Criticality characteristics

A critical domain may require some unique characteristics for the development of software and system. Such characteristics may include

a) critical quality needs for requirement-eliciting, system and software design, program coding, software and system testing, and configuration management,

b) critical quality needs for operations and maintenance services, and

c) critical quality needs for the total system which may require additional software and/or system functionality.

These criticality needs may relate with some software quality characteristics as defined in ISO/IEC 25010.

A.2.2 VSE profile characteristics for a critical system/software

The criticality characteristics needed for a VSE profile definition may include

a) overall and strict risk analysis of the target system,

b) clear definition of process responsibilities for both acquirers and suppliers,

c) close and strict communication and reporting mechanism,

d) flexible problem resolution mechanisms,

e) regulations and legal requirements for the specific domain,

f) business conventions for the specific domain (which may include documentation and/or information formats and documentation and/or information management),

g) use of domain specific quality assurance mechanisms,

h) personnel certification for the specific domain, and

i) capability to provide proper maintenance and customer services.

A.2.3 Integrity level analysis

Software and system are used in a wide variety of situations. Based on this, integrity level requirements for system/software is different according to the system/software environment. The integrity level is

determined based on criticality, recognition, and risk analysis. VSEs should use proper risk analysis approaches. General risk analysis approaches are found in the ISO/IEC 15026 series.

Regulations and the application domain, business importance, safety and security requirements, usability requirements, and results of risk analysis of the target system will affect criticality recognition of the system/software. System/software suppliers and acquirers should consider the integrity level assurance affecting system/software processes and practices.

For example, medical device is regulated by the medical device technical environment and social regulations. Automotive system/software, space industry system/software, and financial domain system/software have their own QCD requirements and regulations. Specific additional processes or practices may be required to implement the system/software processes for such domains.

A.3 Analysis for Generic Profile Group development

A.3.1 General

VSEs are subject to a number of characteristics, needs and desirable competencies that affect the contents, nature, and extent of their activities. The Basic Profile (ISO/IEC 29110) addresses a subset of VSEs which are described through the following characteristics, needs and desirable competencies, classified into four categories: finance and resources, customer interface, internal business processes and learning and growth.

A.3.2 Finance and resources

A.3.2.1 Characteristics:

Characteristics for finance and resources of the Generic Profile Group include

a) small number of engineers (e.g. the cost of a payroll up to 25 people),

b) short term cash flow of each project,

c) low-budget projects that last a few months and involve few people to develop small products,

d) dependency on successful project completion within schedule and budget,

e) separate project to perform corrective post-delivery maintenance, and

f) limited internal resources to perform management, support and organizational processes like risk management, training, quality management, process improvement and reuse.

A.3.2.2 Needs and desirable competencies

Needs and desirable competencies for finance and resources of Generic Profile Group include

a) needs and competencies to perform the projects within the budget and to deliver the product on schedule, and

b) needs and competencies to maintain close communication with the customer to manage risks.

A.3.3 Customer interfaces

A.3.3.1 Characteristics

Characteristics for customer interfaces of Generic Profile Group include

a) one customer per project at a time,

b) customer satisfaction that depends on the following:

   1) fulfilment of specific requirements that may change during the project;

   2) timely information exchange during the product development;

   3) delivery on schedule;

   4) low level of defects found post-delivery;

   5) close communication and prompt responses to any changes;

c) lack of quantitative quality requirements defined by the customer;

d) limited lifecycle responsibility that a VSE is usually not in charge of the management of the system, the software integration, installation and operation.

A.3.3.2 Needs and desirable competencies

Needs and desirable competencies for customer interfaces of Generic Profile Group include

a) fulfilment of customer requirements,

b) management of the change of customer requirements during the project,

c) practices to provide close communication and timely updated information to the customer during the product development, and

d) delivery of the product with low level of defects.

A.3.4 Internal business processes

A.3.4.1 Characteristics

Characteristics for internal business processes of Generic Profile Group include

a) situation that the main process is to develop custom software systems, written in house on contract,

b) situation that the software product is elaborated progressively and has to be consistent with customer requirements,

c) situation that the products are developed or maintained through projects with a single line of communication between the implementation group and customer,

d) a small number of engineers (e.g. up to 25 people) in the organization, resulting the situation that most of the communication, decision making and problem resolution can be performed promptly face to face,

e) lean Project Management addition to focused Software Implementation activities,

f) face-to-face informal mechanisms for Infrastructure Management, Project Portfolio Management and Human Resource Management Processes, and

g) situation that products generated in projects are software items which may have more than one version and have to be saved and controlled.

A.3.4.2 Needs and suggested competencies

Needs and desirable competencies for internal business processes of Generic Profile Group include

a) version control and storage of the products generated during the project, and

b) progressive elaboration of the software product, achieving consistency with customer requirements.

A.3.5 Learning and growth

A.3.5.1 Characteristics

Characteristics for learning and growth of Generic Profile Group include

a) awareness of the importance of standards,

b) lack of human resources to engage in standardization,

c) lack of information of ISO/IEC standards,

d) lack of knowledge of software process improvement and process evaluation.

A.3.5.2 Needs and suggested competencies

Needs and desirable competencies for learning and growth of Generic Profile Group include guidelines, flexible and easy to use for beginners, to adopt practices of International Standards focused on processes to support their software development project's needs.

Annex B
(informative)

Classification of situational factors on software development

B.1 General

Various situational factors for system/software development should be considered in developing a domain-specific profile for VSEs. Such factors may be classified and evaluated with their priorities in the profile development.

B.2 Example of classification and situational factors

A study on situational factors extracted the following classification items, as well as situational factors:

a) personnel which may include factors, such as turnover, team size, culture, experience, cohesion, skill, productivity, commitment, and lack of agreement;

b) requirements which may include factors, such as stability, feasibility, standardization, and rigidity;

c) application which may include factors, such as degree of project risk, performance, complexity, type, size predictability, connectivity, reuse, development phase, deployment profile, and quality;

d) technology which may include factors, such as knowledge, and emerging technology;

e) organization which may include factors, such as maturity, management commitment, stability, structure, facilities, and size;

f) operations which may include factors, such as end-users, and prerequisites;

g) management which may include factors, such as expertise, accomplishment, and continuity;

h) business which may include factors, such as external dependencies, business drivers, time to market, customer satisfaction, payment arrangements, opportunities, and magnitude of potential loss.

Annex C
(informative)

Tools and services

C.1 General

A VSE may use free or open source support software tools for their processes. A specific VSE profile for a specific application domain or specific criticality may specify recommended tools to support its processes. The Cloud environment may provide support tools for system/software processes. Such tools and/or services include, but are not limited to, the following.

C.2 Requirement engineering tools

Requirement engineering tools includes requirement analysis tools, such as quality function deployment tools.

C.3 Development documentation tools

Development documentation tools include

a) QA tools, templates and forms;

b) text and/or program editors;

c) web servers, browsers and Cloud application for Cloud documentation.

C.4 Design Tools and development support tools

Design tools and development support tools include

a) integrated development environments;

b) text and/or graphic editors with advanced functionalities;

c) design documentation tools such as UML;

d) rapid development support tools.

C.5 Communication tools

Communication tools include

a) mail servers and clients with mailing-list functionality;

b) collaboration and discussion tools;

c) knowledge data bases;

d) social networking tools and services.

C.6 Review tools

Review tools include

a) document analysis tools;

b) quality assurance tools and templates;

c) problem/anomaly tracking tools.

C.7 Quality management tools

Quality management tools include

a) problem tracking tools;

b) check lists for quality management.

C.8 Development rules including coding rules

Development rule supporting tools includes static and dynamic code analysers.

C.9 Configuration management and process resource repository

Configuration management tools include

a) version control tools;

b) configuration management tools and services;

c) product line configuration management tools;

d) quality assurance tools and templates.

C.10 Project management tools

Project management tools include

a) project, schedule and resource management tools;

b) problem/anomaly tracking tools;

c) enterprise project portfolio management tools.

Annex D
(informative)

Example of a VSE profile definition

D.1 General

For the development of a new profile for a domain-specific domain, simple and easy procedures are desirable. An existing VSE profile may be used instead of the original base International Standard, probably with some additions of selected items from the International Standards.

D.2 Example of a simplified profile definition and base-standard-reference tables

An example of a simplified profile definition and base-standard-reference tables are shown at Tables D.1 to D.4. These tables have top rows for the profile element 1 or 2 name. They also may have rows in the middle for profile element 1 classification (e.g. PM or SI). Such table construct is for simplification and for avoiding duplication.

The column of Notes/Rationale is used for additional notes and rationale description to explain why each corresponding items are selected or deleted in the defined profile.

The example also use notation such as PM-x. Here PM-x means a collection of all PM-1, PM-2, and so on.

BP is an abbreviation of the Basic Profile. WP is an abbreviation of the workproduct.

As stated in Figure 4, a domain-specific profile correspondence table (base-standard-reference table) is not required for publication. Such tables of this kind are optional.

Table D.1 — Example of a process definition table

Element 1 type		Process
Profile Element 1 ID	Element name/description	Notes/rationale.
PM	Project Management	Based on BP.
SI	Software Implementation	Based on BP.
CM	Configuration Management	Added based on risk analysis.
Abbreviation: BP: Basic Profile (ISO/IEC 29110-4-1).		

Table D.2 — Example of a process activity definition table

Element 2 type		Activity
Profile Element 2 ID	Element 2 name/description	Notes/rationale.
Profile Element 1(Process)	PM	
PM.x	(default activities)	Same as BP.
PM.5	Project Risk Management	Added to BP. Requirement management is critical.
Profile Element 1(Process)	SI	
SI,x	(default activities)	Same as BP excepting below.
SI.1 (deleted)	Software implementation initiation	Deleted. It is merged to PM.1 and SI.2
Abbreviation: BP: Basic Profile (ISO/IEC 29110-4-1).		

Table D.3 — Example of a process activity reference table

Element 2 type			**Activity**		
New profile activity			**Base International Standard reference** (ISO/IEC 29110-4-1)		
Profile Element 2 ID	Name/description		Profile Element 2 ID	Name/description.	Notes/rationale.
Profile Element 1(Process)		PM			
PM.x	(default activities)		PM.x	Same as BP.	
PM.5	Project Risk Management		(N/A)		Added to BP. Requirement management is critical.
Profile Element 1(Process)		SI			
SI.x	(default activities)		SI.x	Same as BP excepting below.	
SI.1 (deleted)	Software implementation initiation		SI.1	Software implementation initiation	Deleted. It is merged to PM.1 and SI.2

Table D.4 — Example of a workproduct reference table

Element 1 type		Workproduct		
New Profile workproduct		**Base document reference** (ISO/IEC 29110-4-1)		
Profile Element 1 ID	Name/description	Profile Element 1 ID	Name/description.	Notes/rationale.
WP.	(default products)	WP.x	Same as BP.	
WP.23 (deleted)	Validation results	WP.23	Validation results.	Deleted. Validation is not required in business convention.
WP.A1	Security risk requirement and verification	(N/A)		Added to BP. Security requirement management is critical.
WP.A2	Safety risk requirement and verification	(N/A)		Added to BP. Safety requirement management is critical.

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