TECHNICAL REPORT

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

Part 3-4: Autonomy-based improvement method

Ingénierie des systèmes et du logiciel — Profils de cycle de vie pour très petits organismes (TPO) —
Partie 3-4: Guide pour la méthode d'amélioration fondée sur l'autonomie

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

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 this part 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, recognition of VSEs as suppliers of high quality products is required.

According to the Organization for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook report (2005), “Small and Medium Enterprises (SMEs) constitute the dominant form of business organization in all countries world-wide, 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 lifecycle 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/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 ISO/IEC 29110 specifications.

The ISO/IEC 29110 series of International Standard and Technical Reports can be applied at any phase of system or software development within a lifecycle. ISO/IEC 29110 (all parts) 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.

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
Part 1	Overview	VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.
Part 2	Framework	Profile producers, tool vendors and methodology vendors. Not intended for VSEs.
Part 3	Assessment guidance	VSEs and their customers, assessors, accreditation bodies.
Part 4	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
Part 5	Management and engineering guide	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 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 and International Standards.

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, conformance, 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 29110-3 defines certification schemes, assessment guidelines and compliance requirements for process capability assessment (ISO/IEC 33xxx), conformity assessments (ISO/IEC 17xxx), 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 a management and engineering guide for each profile in one profile group.

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

This part provides a guide for an autonomy-based improvement method for VSEs developing systems and/or software.

Figure 1 describes the International Standards (IS) and Technical Reports (TR) of ISO/IEC 29110 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).

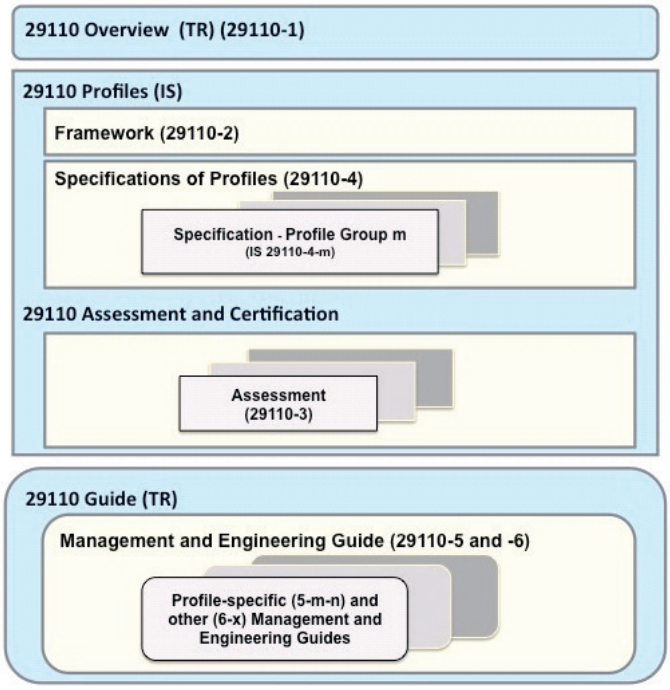

Figure 1 — ISO/IEC 29110 series

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

Part 3-4: Autonomy-based improvement method

1 Scope

1.1 Fields of application

ISO/IEC 29110 series is applicable to Very Small Entities (VSEs). A VSE is an enterprise, an organization, a department or a project having up to 25 people. The lifecycle processes described in ISO/IEC 29110 are not intended to preclude or discourage their use by organizations bigger than VSEs.

The lifecycle processes defined in ISO/IEC 29110 can be used by VSEs when acquiring, using, creating, and supplying, a system or a software. They can be applied at any level in a system/software's structure and at any stage in the lifecycle. The processes described in ISO/IEC 29110 are not intended to preclude or discourage the use of additional processes that VSEs find useful.

The autonomy-based improvement method, described in this part of ISO/IEC 29110, provides a tool to improve the "way of work" (i.e. a process) regarding systems and software development practically. This process includes defining a technological theme (objectives), the outcome regarding the theme, and implementing activities to steadily gain the outcome.

This method can be used in various situations such as

— improvement tool for development teams,

— self-training or self-check tool for engineers, and

— improvement tool for the VSE.

This method expects practitioner's self-help efforts and initiatives (both physically and mentally) to make the most of the predecessors' knowledge, experience or assets, which are required. Therefore, this method encourages the utilization of the knowhow/knowledge through its available tools. Through this method, the practitioner is encouraged to generate ideas for improvement but also to apply them to their work using an ISO/IEC 29110 profile.

This part of ISO/IEC 29110 provides a guide for an autonomy-based improvement method for VSEs developing systems or software products.

1.2 Target audience

This part of ISO/IEC 29110 is targeted at VSEs that want to improve their activities by using an autonomy-based improvement method. And also this encourages tool/methodology vendors to provide practical tools for VSE.

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, *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 and the following apply.

3.1
process improvement
actions taken to improve the quality of the organization's processes aligned with the business needs

[SOURCE: ISO/IEC 33001:2014]

3.2
autonomy-based improvement
self-motivated and self-determined professional process improvement with an understanding of the work (process) objectives, latest technology, and outcomes from product use

4 Conventions and abbreviated terms

4.1 Naming, diagramming, and definition conventions

None.

4.2 Abbreviated terms

SPI system/software process improvement

VSE very small entity

5 Process improvement context for VSEs

5.1 Considerations of related standards for VSEs

The VSE Profile is defined as a subset of processes and outcomes from ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 and information items (documentation) from ISO/IEC/IEEE 15289. The processes, defined in ISO/IEC 29110-4-m, are the minimum set for the VSE core business, systems/software development. Their financial success depends on successful project completion within schedule and budget.

5.2 Rationale of the process improvement for VSEs

To implement a profile using a contract, statement of work, or agreement, the work must be defined based on the customer requirements, supplemented by the VSE business practices/conventions, and accepted by the customer.

A VSE system/software development project follows the VSE Management and Engineering Guide to fulfil the statement of work or agreement and generate the products. The VSE can perform other activities in support of a specific project.

In order to implement a profile, a VSE can follow ISO/IEC TR 29110-5-m-n, which is a collection of selected and structured process elements such as: objectives, activities, tasks, roles and work products. For concept definition, see ISO/IEC 29110-4-m.

To assess process capability of a VSE, ISO/IEC TR 29110-3-1 Capability Assessment guide with Measurement Framework (MF) and Process Assessment Model (PAM), and ISO/IEC 29110-4-m Profile

specifications: Generic profile group with Process Reference Model (PRM), provide the assessment scheme for the specific profile.

For self-improvement, this document should be used to look for opportunities and problems, through awareness analysis, to improve the project in an autonomous manner.

The assessment and autonomy-based improvement are complementary and support each other.

Figure 2 illustrates the relationship between assessment and improvement in a project.

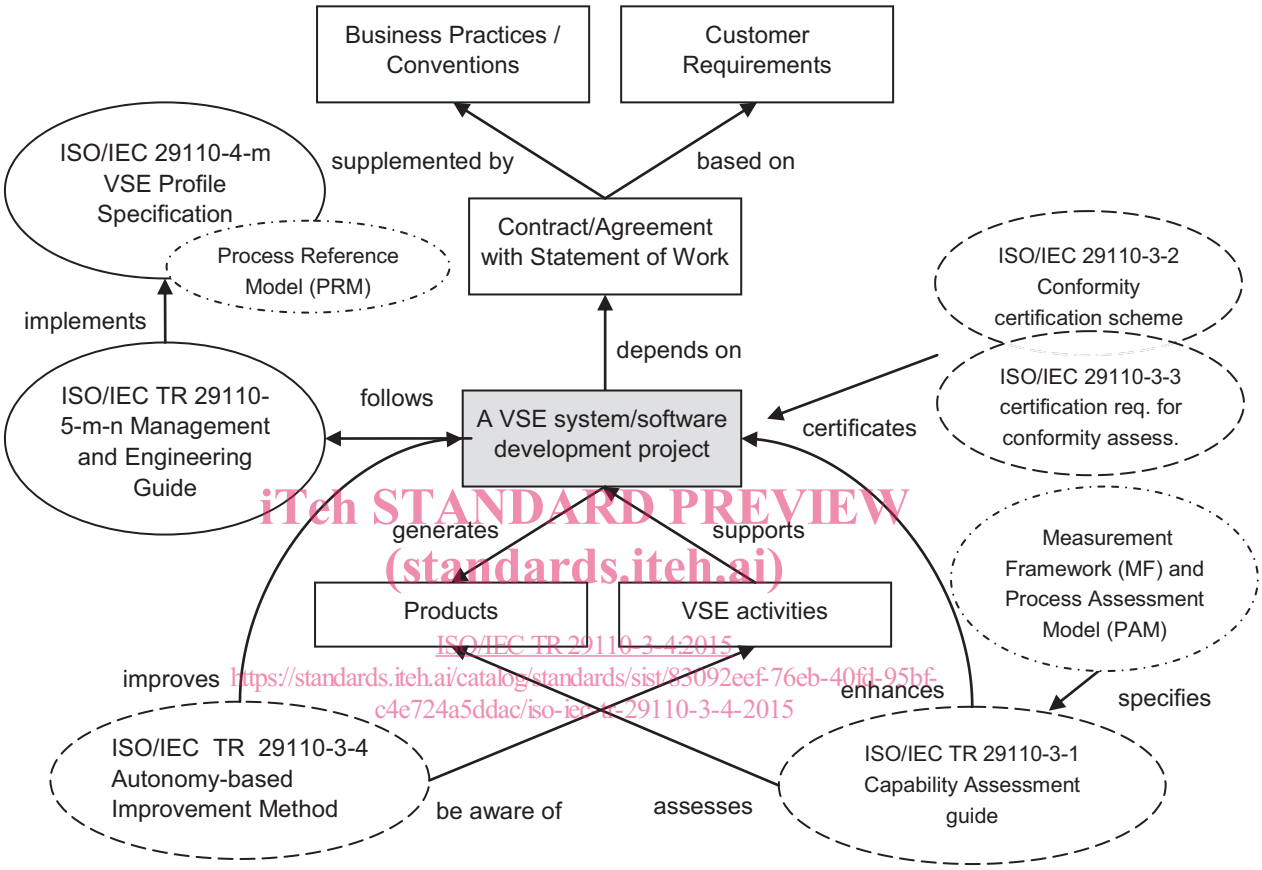

Figure 2 — Assessment and improvement for a project

NOTE The interpretation of the diagram notation is as follows: the rectangle represents the VSE elements; the ellipse represents the standard, the round rectangle represents a subset of elements of the base standard; dashed ellipses represent standards in work to be published; solid arrows are labelled relationship; and a circle with a dashed arrow is the sequence of the step.

6 Process improvement approach for VSEs

When a VSE's management or engineers want to improve their processes, they may need an improvement approach that is easy for the VSE to apply. General guidance for process improvement is given in ISO/IEC/TR 33014, which is focused on the organizational approach for improvement.

Excessive emphasis on organizational efforts sometimes reduces the practitioners' awareness and motivation for real improvement. This guide provides an autonomy-based process improvement approach that places more emphasis on awareness and motivation factors for people working in VSEs to improve their processes.

In addition, a self-check improvement cycle is an effective way for VSEs to recognize their improvement when using this approach.

7 Characteristics for autonomy-based approach

7.1 General

Process improvement should be based on the needs and priorities of the VSE. The competence and the will of the people impact the process improvement efforts of a VSE.

7.2 Autonomy

On-site day-to-day activities performed by a work team are subject of process improvement, with autonomy. Process improvement awareness and motivation are essential for success and should be based on the will of the people.

It is important to share the value of a good job with good performance for autonomy.

7.3 Conciseness and easiness to understand

A VSE may not have enough resources to perform sophisticated process improvement activities. The methods (total framework, organization, activities, and documents) and guidelines for VSE process improvement should be clear and concise.

The VSE staff may not have enough experience and knowledge of software engineering processes, process models, methods and guidelines for process improvement, therefore they should be easy to understand.

7.4 Low cost, quick cycle and controllable

Performing process improvement activities within a VSE should be low cost and cost effective. VSEs normally have small margins of technical resources and finances. Cost effectiveness can be demonstrated by successful, quick, agile improvement cycles and flexible control of the improvement activities.

7.5 Confidence of effectiveness and necessity

Confidence in technical effectiveness and the necessity for improvement are key factors of autonomy-based improvement. The methods and guidelines for process improvement for a VSE should offer effective improvement activities.

Improvement should be based on the facts and reality of actual VSE projects. A rigid requirement on processes, different than the VSE's actual processes, may cause less motivation and productivity. The lack of a standardized process may lead to difficulties, such as non-performing software, interrupted software service, lack of sound labour environment, lack of maintainability, user complaints, etc.

— Collaborative efforts by the work team will positively contribute to effective confidence and overall process improvement.

— Results of improvement activities should provide a positive effect on daily work, and should re-enforce worker confidence.

— The awareness of continuous process improvement is an important and inevitable part of system/software lifecycle processes that should be established throughout the improvement cycle.

7.6 Communication with stakeholders and communities

Process improvement should not be just for the VSE's self-satisfaction. It should be understood and accepted by all stakeholders that process improvement is important to develop better products, strong relationships, and provide benefits to everyone. Collaboration is desirable between stakeholders when performing process improvement.