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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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Contents

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**
1.1 Fields of application ... 1
1.2 Target audience ... 1

2 Normative references ... **1**

3 Terms and definitions ... **2**

4 Conventions and abbreviated terms ... **2**
4.1 Naming, diagramming, and definition conventions ... 2
4.2 Abbreviated terms ... 2

5 Process improvement context for VSEs ... **2**
5.1 Considerations of related standards for VSEs ... 2
5.2 Rationale of the process improvement for VSEs ... 2

6 Process improvement approach for VSEs ... **3**

7 Characteristics for autonomy-based approach ... **4**
7.1 General ... 4
7.2 Autonomy ... 4
7.3 Conciseness and easiness to understand ... 4
7.4 Low cost, quick cycle and controllable ... 4
7.5 Confidence of effectiveness and necessity ... 4
7.6 Communication with stakeholders and communities ... 4

8 Framework of process improvement ... **5**
8.1 Initiation of improvement ... 5
8.2 Activities of improvement ... 5
8.2.1 Activity 1: Awareness of process problems ... 5
8.2.2 Activity 2: Analysis of problems and their relationships ... 5
8.2.3 Activity 3: Analysis of the root cause of problems ... 5
8.2.4 Activity 4: Identification of a process or processes relating to the root cause ... 5
8.2.5 Activity 5: Clarification of the fundamental purpose, outcomes, and practices of the process ... 5
8.2.6 Activity 6: Study on best practices on the process ... 6
8.2.7 Activity 7: Develop improvements to eliminate or mitigate problems ... 6
8.2.8 Activity 8: Evaluate the improvement plan for feasibility and impact ... 6
8.3 Continuous improvement cycle ... 6
8.4 Improved communication and agreement ... 6
8.5 Competency for improvement ... 7
8.6 Enhancement tools for improvement ... 7
8.7 Preparation or selection of a VSE profile ... 7

9 Improvement means growth and innovation ... **7**

Annex A (informative) **Example: SPINA^{3}CH method for the basic profile** ... **8**

Annex B (informative) **Adapting various profiles with the SPINA^{3}CH method** ... **20**

Bibliography ... **22**

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).

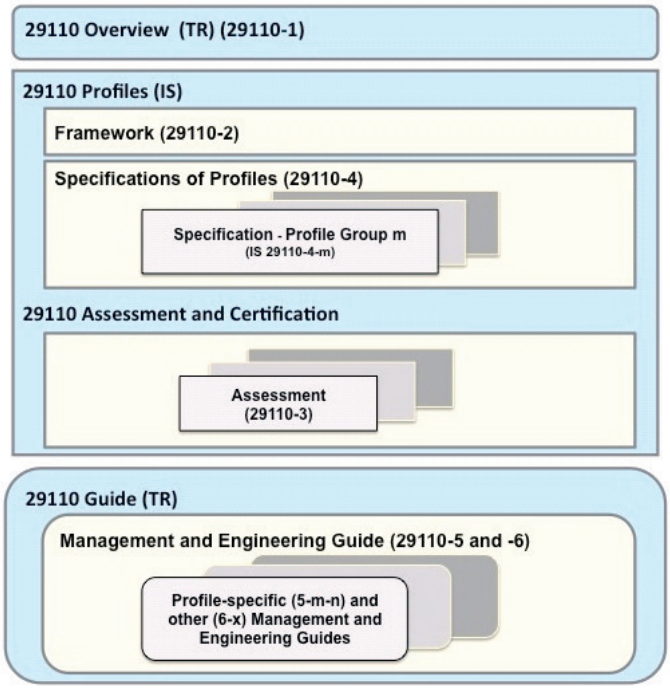

Figure 1 — ISO/IEC 29110 series

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.

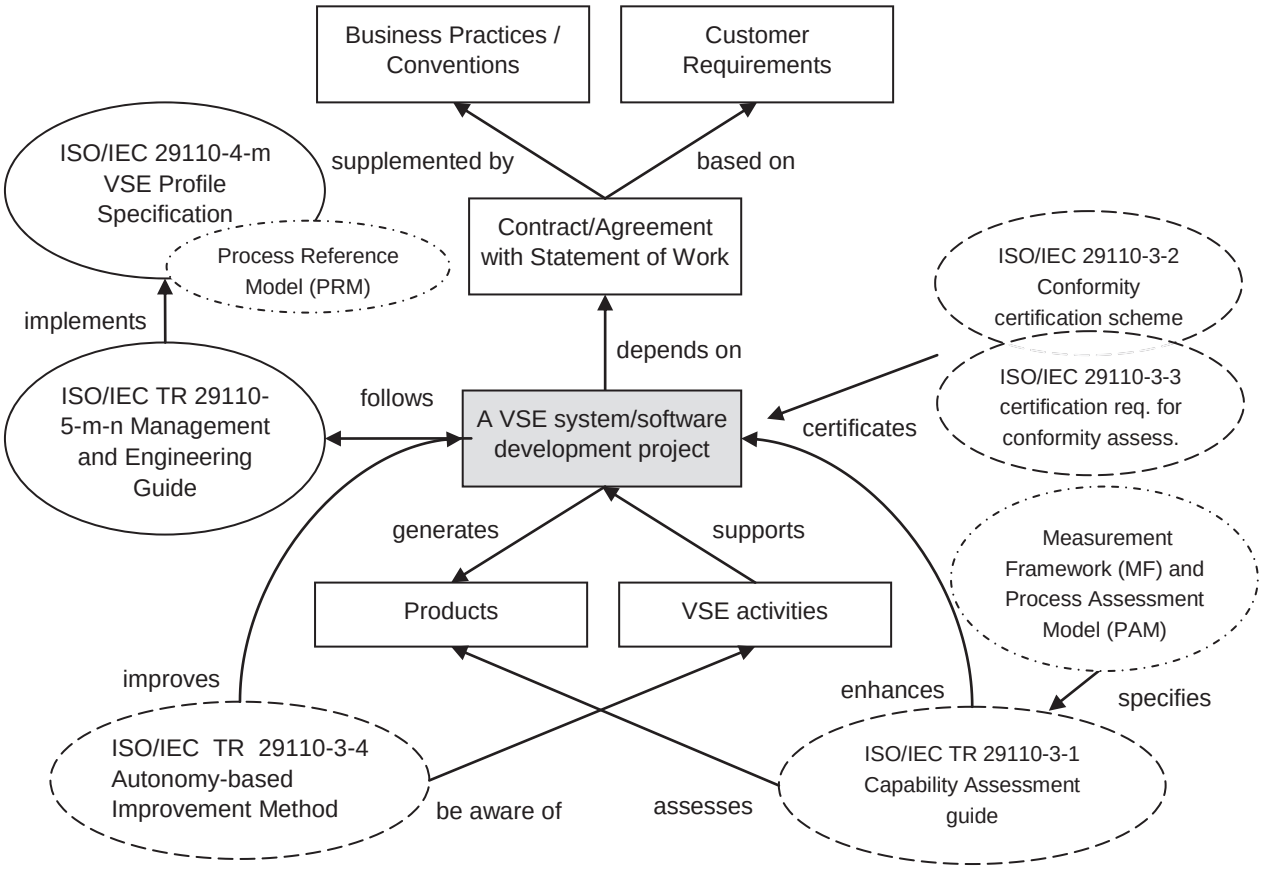

Figure 2 — Assessment and improvement for a project

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.

Process improvement should reflect the experiences and technologies currently used in the system or software project. A team leader, an improvement facilitator, and/or technical experts may support technology transfers from outside of the VSE.

8 Framework of process improvement

8.1 Initiation of improvement

Process improvement should be initiated based on the awareness of process problems. Problems may be identified by work team members, project managers, customers, or quality aware personnel. Without a complete understanding of the problem, introducing a new system/software lifecycle processes may influence various process problems. Also system/software product problems may be related to process problems.

It is desirable to provide process improvement initiatives to the work team members. All process improvement team activities should have management support.

Autonomy-based process improvement activities performed by a self-improvement team should include the items shown in 8.2.

8.2 Activities of improvement

8.2.1 Activity 1: Awareness of process problems

Team identified problematic issue found in the system/software lifecycle workflow. This may be presented as a diagram. See Figure A.2 for an example.

8.2.2 Activity 2: Analysis of problems and their relationships

The team analyses of all issues and determination of the relationships between them. If necessary, new implicit issues are identified. As a result these relationships, the team can understand the overall situation.

8.2.3 Activity 3: Analysis of the root cause of problems

The purpose of this improvement approach is to find the cause of difficulties. In an autonomy-based process improvement, a team should identify an improvement target which is within their control. It may be the root cause of an issue, which then may be the starting point for improvement. A team may not be able to improve every situation when the root cause of the difficulty is outside of their control.

8.2.4 Activity 4: Identification of a process or processes relating to the root cause

The team should identify which process is their concern, based on the identified root cause of the problem. Based on this, they should select one of the standardized activities, or develop a new activity that will meet their needs.

8.2.5 Activity 5: Clarification of the fundamental purpose, outcomes, and practices of the process

The team should aware of the purpose and objectives of their work.

The team should identify the current practices/activities actually performed. They can also identify the pros and cons of such practices/activities, and identify improvement candidates based on the results of Activity 3.

The team should reconsider the purpose and outcomes of the selected process. This is not a cut-and-paste of standardized items, but reconfirmation of the real purpose and outcomes of their process. Through this procedure the team can define the core characteristics of their process.

8.2.6 Activity 6: Study on best practices on the process

The team should understand the solid practices to improve the process. Such practices may be technical or management-oriented. The team should study the feasibility of applying the candidate practices.

8.2.7 Activity 7: Develop improvements to eliminate or mitigate problems

The team should develop technical efforts and a plan to change the current activity practices to be improved. The plan should be solid, controllable, and low cost with a quick improvement cycle. The plan should eliminate or mitigate the original problems.

8.2.8 Activity 8: Evaluate the improvement plan for feasibility and impact

The team should coordinate with the stakeholders on performing the improvement plan. They should update the ideas and incorporate the results of the discussions and add the success criteria to the improvement plan.

8.3 Continuous improvement cycle

In a continuous improvement cycle, "trial and error" approach is important. It is difficult to make a perfect and positive plan for improvement. The improvement team should evaluate their progress on improvements and update the plan appropriately.

The following activities should be performed to support a steady and effective process improvement effort.

— Activity 9: The periodic and timely review of progress of improvement activities.

— Activity 10: The management of the improvement program and improvement cycle.

— Activity 11: The accumulation of knowledge and skills about the processes and improvements.

8.4 Improved communication and agreement

Improvements will be performed smoothly when there is firm agreement among stakeholders. Good communications is the basis for good system/software process improvement (SPI) practices. This may include the following:

— negotiations with all stakeholders within the VSE;

— commitment of senior managers to support the improvement efforts;

— communications with customers on all process changes;

— awareness of the process purpose relating to business goals (competitiveness);

— study of other process improvement efforts and their results;

— communications with process-enhancement tool providers;

— communications in the system/software engineering community;

— communications with global system/software improvement networks;

— collection and analysis of engineering data to develop confidence in the improvement efforts and to identify potential problems;

— collection of improvement related information for future projects to use.

8.5 Competency for improvement

Autonomy-based improvement does not exclude any competency roles or leadership. Such roles may include the following.

— Work team as a subject of improvement.

— Improvement facilitator to lead improvement workshops/meetings. (Improvement facilitators should have the experience to lead the improvement activities, to include system/software engineering process knowledge and skills.)

— Technical experts to provide the knowledge and skills for process improvement effort.

— Team leader to support and work with the improvement facilitator.

— Stakeholders to provide the requirements, collaboration, knowledge and skills for the improvement effort.

8.6 Enhancement tools for improvement

Various support tools to enhance and improve process activities may be useful. The VSE may use such support tools to fill the needs of process performance and to enhance their process capability.

Such tools may include the following:

— improvement activity support tools (e.g. cause analysis tools and improvement planning);

— process repository tools (e.g. project configuration management servers and Wiki);

— process support tools (e.g. design support tools).

Examples including work products and deliverables are explained in Annex A.

8.7 Preparation or selection of a VSE profile

Actual workflows vary depending on the context. An appropriate workflow for problem analysis should be chosen or developed. This workflow may be related to a specific profile. The improvement team may select one of the existing profiles for their improvement purposes. If they cannot find an appropriate profile as defined in ISO/IEC 29110-4-m, they may develop their own profile based on ISO/IEC 29110-2.

A profile also provides the basis for clarification of the fundamental purpose, outcomes, necessary practices of the process, and the development of an improvement plan.

9 Improvement means growth and innovation

In general, a VSE needs continuous process improvement to grow. Such improvement does not exclude a big change of processes or innovation.

The successful continuous improvement will result in the growth of the VSE and their workforce.

Annex A
(informative)

Example: SPINA^{3}CH method for the basic profile

A.1 Method Concept of SPINA^{3}CH autonomy-based improvement method

A.1.1 Introduction of SPINA^{3}CH (Spinach-Cube)

This method emphasizes autonomy of people or the work team. The system/software development depends on people's creativities and initiatives. The success of process improvement depends on how people are sure about significance of improvement.

The name of the "SPINA^{3}CH" method is the acronym of Software Process Improvement with Navigation, Awareness, Analysis, and Autonomy for CHallenge.

The "Awareness" is awareness of people who actually work for developing a software/system which is the situation of their process realities and difficulties. The people want to solve these problems but sometimes they do not have a map to explore problems.

So the "Navigation" is expected to guide them for developing the software/system. Therefore, "Navigation" is provided within SPINA^{3}CH itself and used as a tool for improvement. "Navigation" also guides process models/standards, software engineering theories and a collection of best practices.

This situation should be "Analysed" to understand cause-result systematic relationships, and to find a focal point of improvement.

The entire activities should be led to the "Autonomy"-based improvement. Such improvement is based on confident improvement motivation and their own knowledge of system/software engineering guided by the navigation. Such improvement motivation should be supported by and contributed to the business objectives for "CHallenge". Such challenge should be accomplished through continuous process improvements by Plan-Do-Check-Act (PDCA) cycles.

This method reflects the characteristics and steps addressed in its name.

Emphasis on autonomy is the key of this method, and the process models are used as a guide and knowledge source for the people/team.

These steps contribute to the "Autonomy" and "Challenge" characteristics of this method.

This Annex shows a simplified software Basic profile version of the SPINA^{3}CH method.

As illustrated in Figure A.1, Any profiles can be used with the SPINA^{3}CH method.

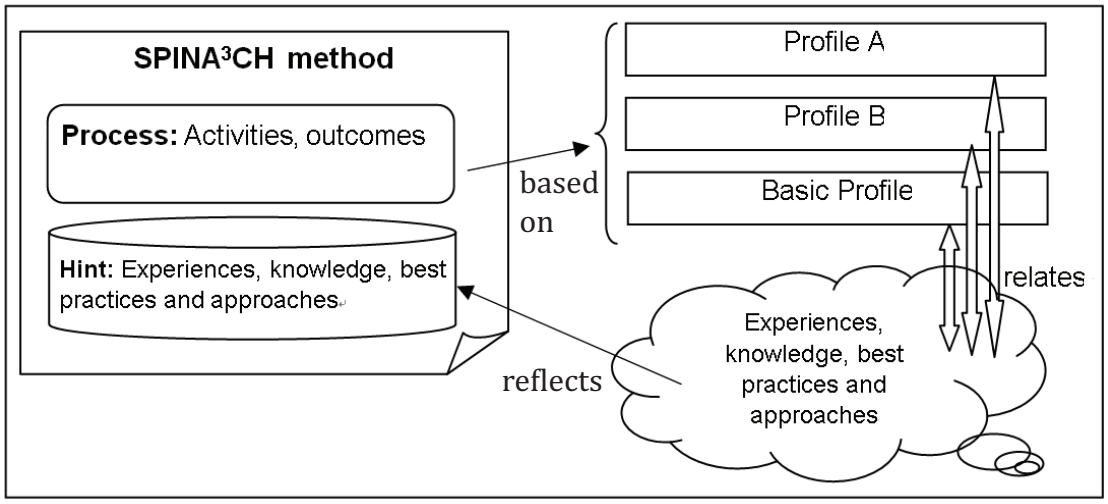

Figure A.1 — SPINA³CH method and profiles

The interpretation of the diagram notation is as follows: the paper shape represents the method; the round rectangle represents embedded process (model); the database like shape represents container; the cloud shape represents human thoughts, the rectangle represents the VSE profile; the arrows are a labelled relation and the left bracket represents grouping of objects.

Usage of a VSE profile other than the Basic profile is shown in Annex B. (See Figure B.1.)

A.1.2 Steps for the method

SPINA³CH autonomy-based improvement method uses the following steps. Those steps are slightly different from improvement activities shown in the body of this standard.

Step 1: Find "difficulty facts" of the development and sense "problems" in it. (This step contributes to the "Awareness" characteristic of the method.)

Step 2: Understand the systematic relationship of the problems. (This step contributes to the "Analysis" characteristic of the method.)

Step 3: Find the root cause of problem where to improve begins. (This step contributes to the "Analysis" characteristic of the method.)

Step 4: Map the root cause of problem to system/software lifecycle processes. (This step contributes to the "Autonomy" characteristic of the method.)

Step 5: Find actual practices and their pros and cons in the current process. (This step contributes to the "Autonomy", "Analysis" and "Navigation" characteristics of the method.)

1) Confirm process/practice purpose and outcomes.

2) Compare actual practices with best practices or those of own/other organizations.

3) Learn software development technologies and management technologies from best practices and community information.

4) Study the usage of candidate useful development/management tools and evaluate them.

Step 6: Make improvement plan for a team/organizational trial communicating with experts and the work team. (This step contributes to the "Autonomy" characteristic of the method.)

Step 7: Develop an action plan for performing improvement. (This step contributes to the "Autonomy" and "Challenge" characteristics of the method.)

Step 8: Improvement cycle

The method requires improvement cycles. (These steps contribute to the “Navigation” characteristic of the method.)

1) Plan improvement with schedule and role details.

2) Perform and control improved process.

3) Check results and perform the next cycle of SPINA3CH.

4) Accumulate and reorganize knowledge.

A.1.3 Tools of the method

This method uses the following tools or worksheets:

— Problem Awareness Sheet (step 1);

— Problem Cards (step 2);

— Problem Analysis/Focus Sheet (step 3);

— Sheet for System/software Engineering Themes (Process Mapping) (step 4);

— Improvement Study Worksheet (step 5);

— Improvement Planning Sheet (step 6,7).

A.2 Detailed Steps of the method

A.2.1 STEP1: Use “Problem Awareness Sheet”

Use “Problem Awareness Sheet” to find out candidate problems occurring in the development lifecycle. This step contributes to clarify current situations of explicit and implicit problems.

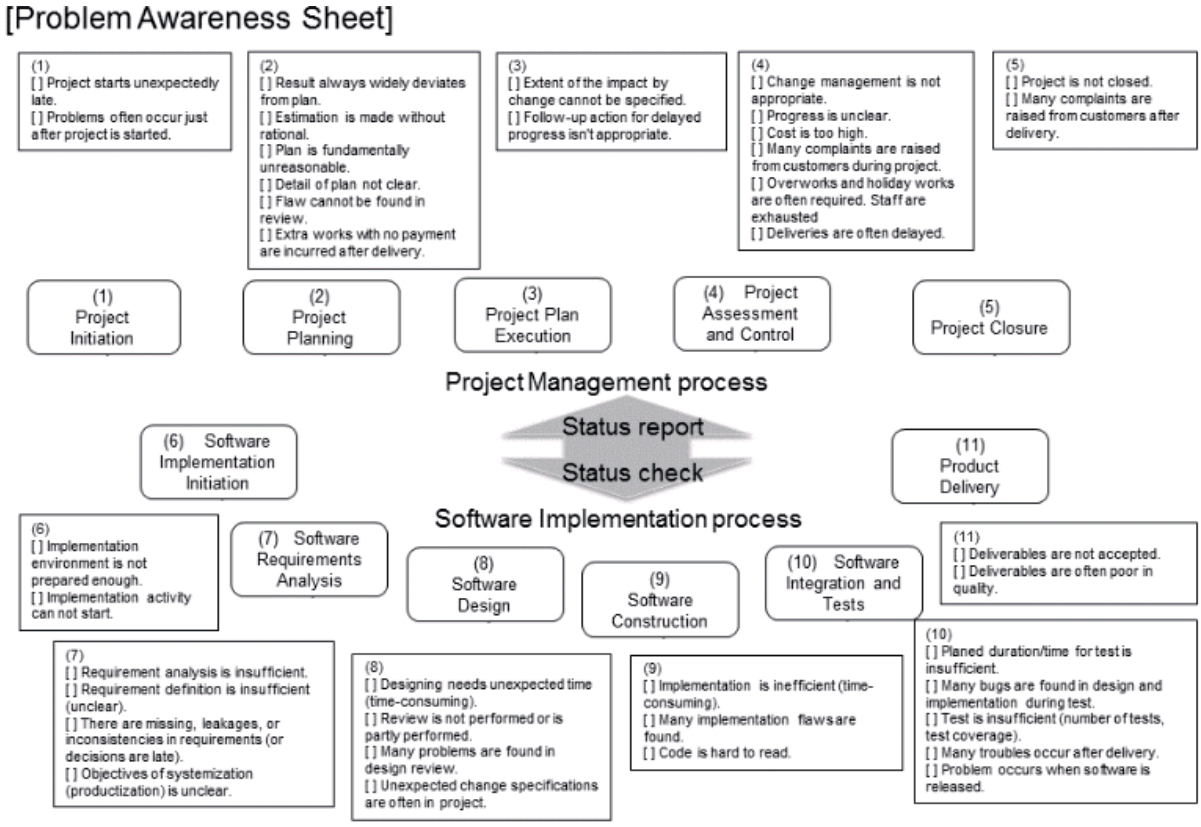

Figure A.2 — Example Problem Awareness Sheet for VSEs

A.2.2 STEP2: Explore problems

Explore problems more precisely and analyse causal relations among them. This step contributes to analyse a structure of problems found in current actual system/software processes.

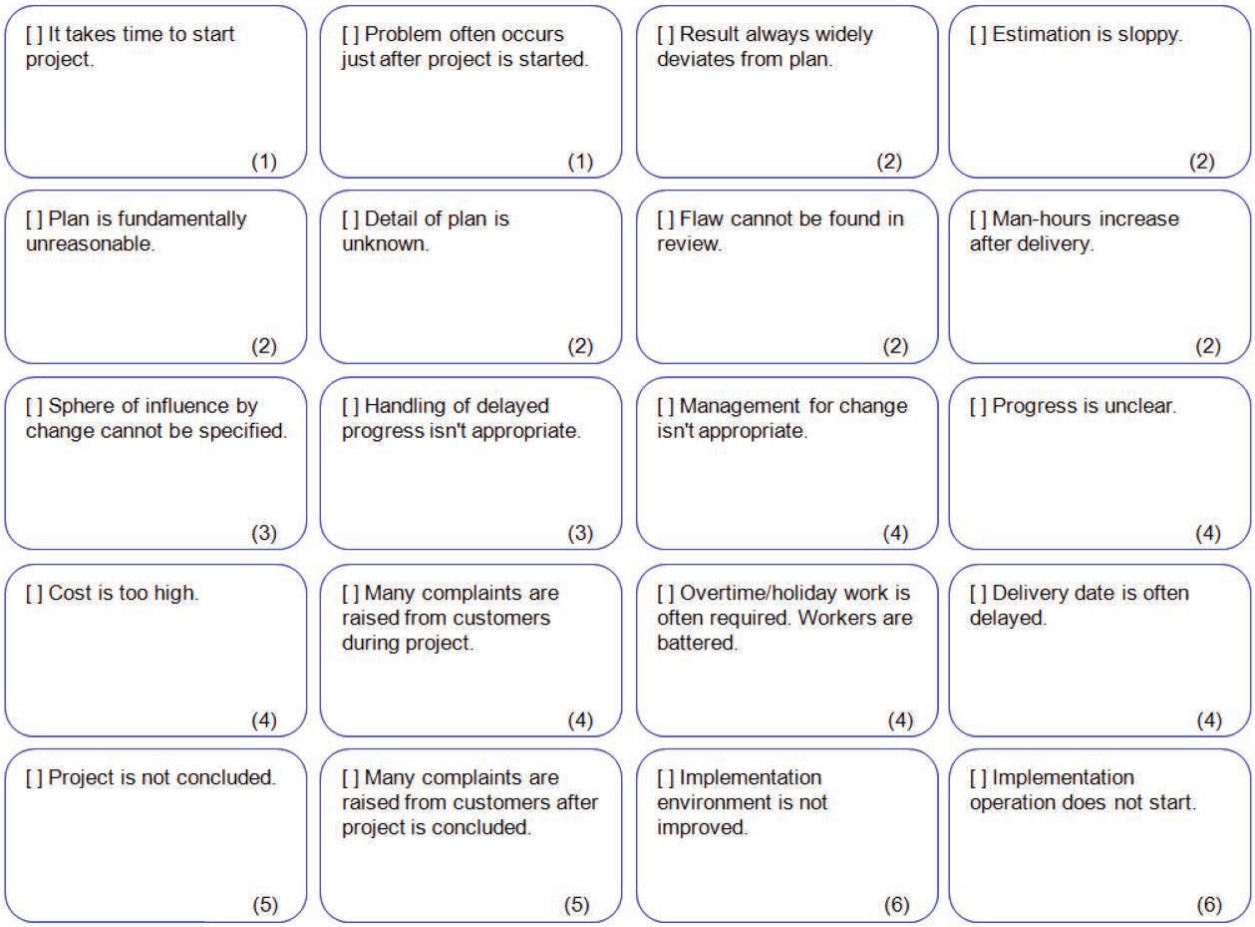

Figure A.3 — Write down the issues and/or problems on the Problem Card example

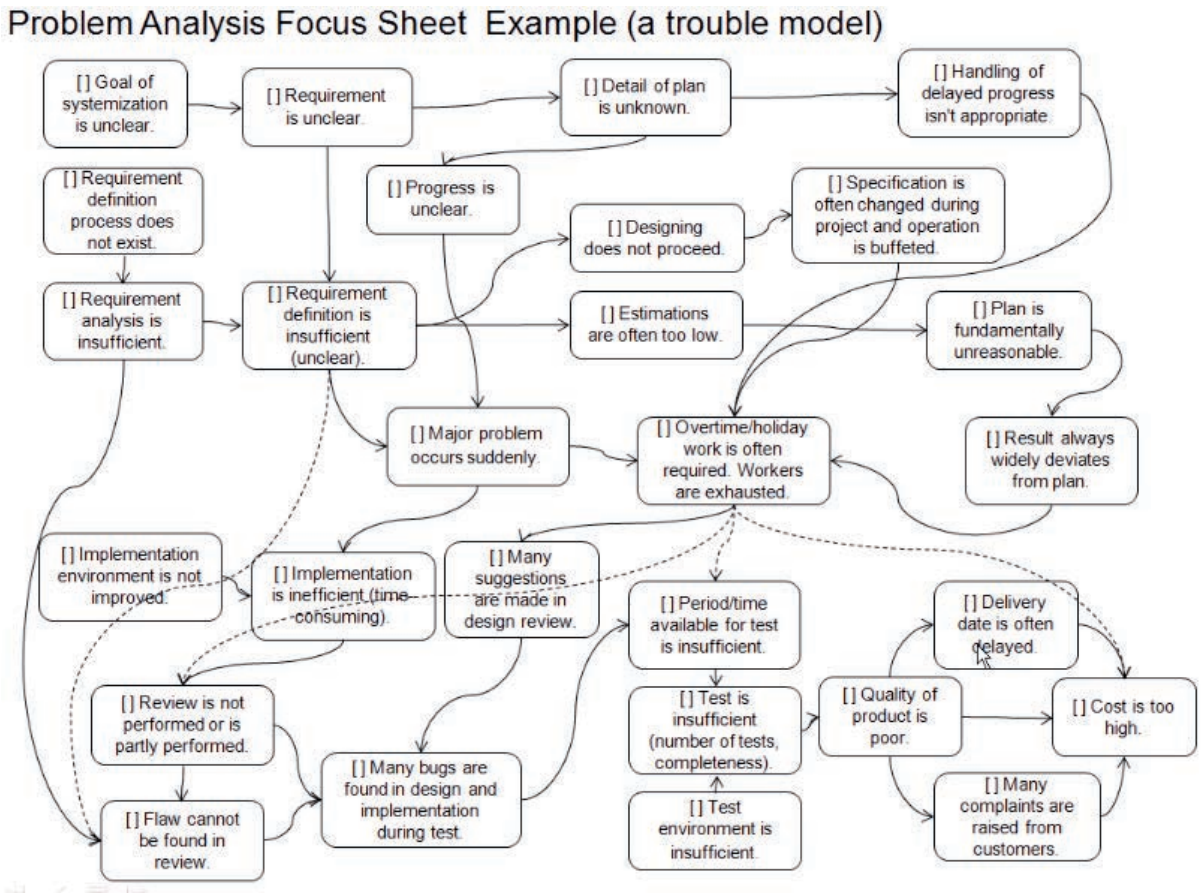

Figure A.4 — Explore the extracted problems and analysing causal relations

A.2.3 STEP3: Focus on the area of improvement

Focus on the area of improvement. This step contributes to prioritize and select a few and practical improvement issues.

Example of focusing on problems with a trouble model

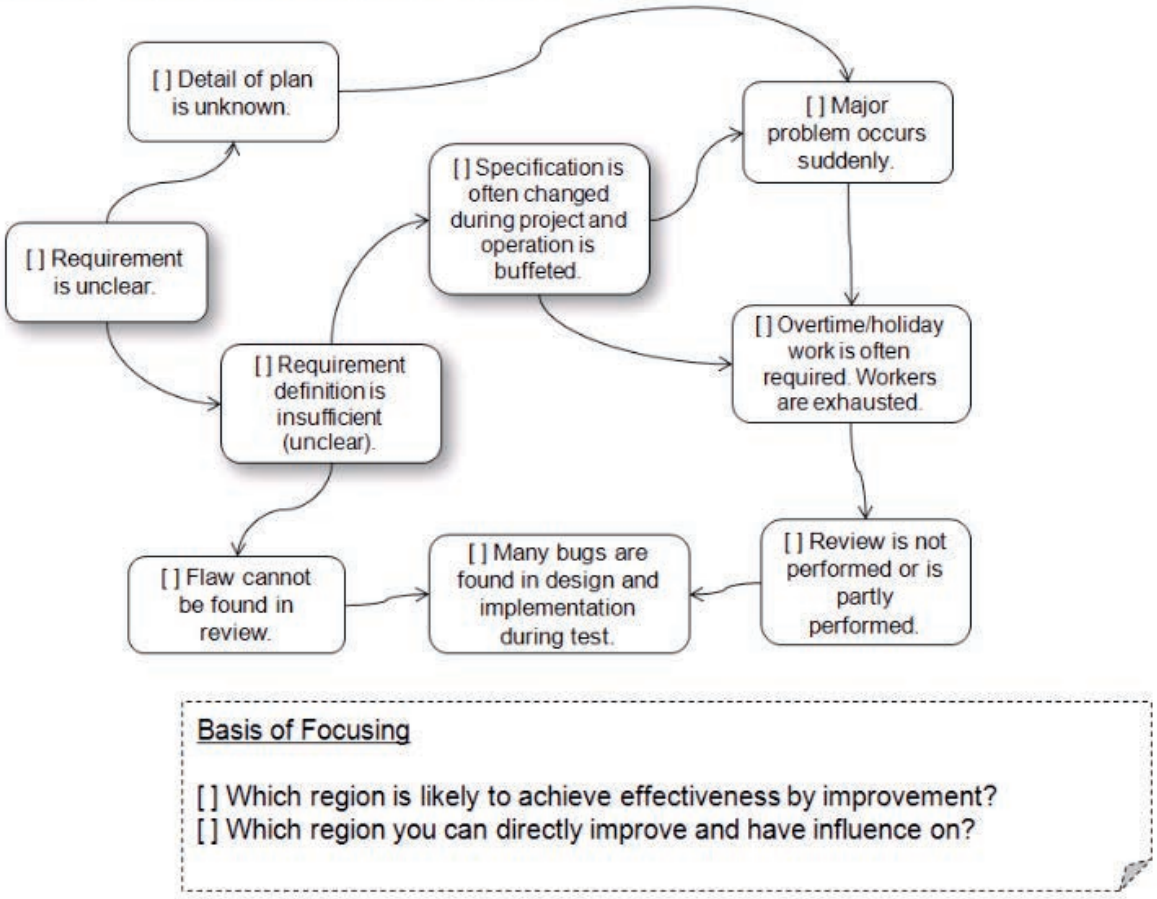

Figure A.5 — Focusing on the area for improvement

A.2.4 STEP4: Select relevant Improvement Study worksheet

Select a relevant Improvement Study Worksheets. This step contributes to convert practitioners' problem concerns to software engineering themes or process items.

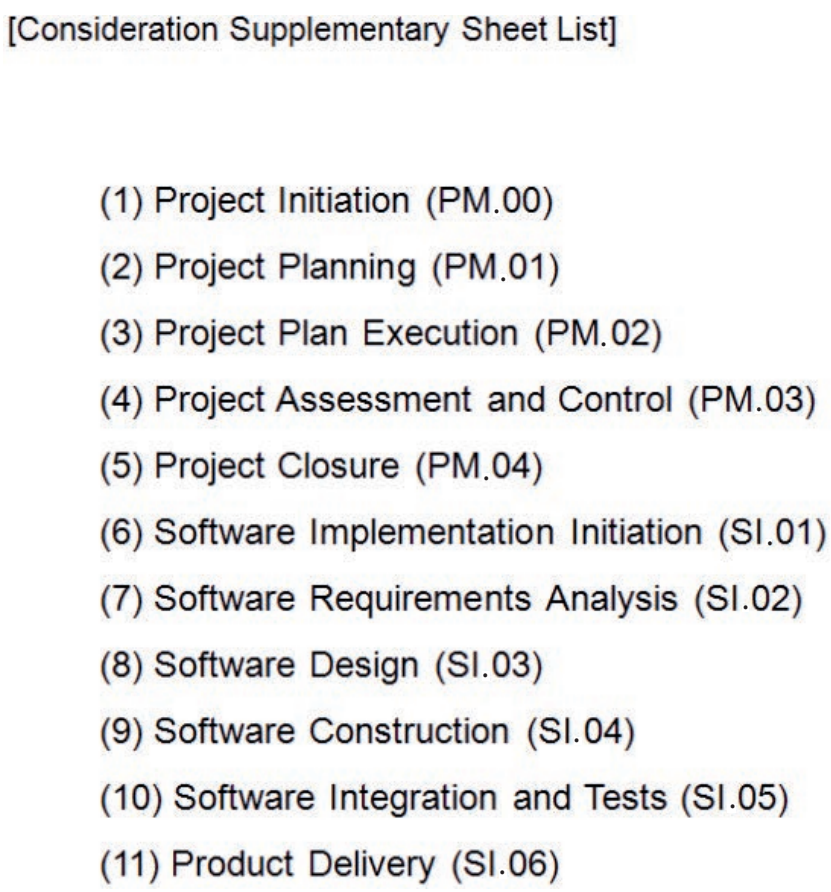

Figure A.6 — Selecting a relevant Study Worksheet

NOTE Worksheets are provided at http://www.ipa.go.jp/sec/softwareengineering/reports/20110707.html.

A.2.5 STEP5: Fill in Study Worksheet

Fill in the items of a relevant Study Worksheet so that you could find solutions by yourself. This step contributes to define your own processes/outcomes, to reconfirm problems of processes, and then to develop improvement ideas. This step also contributes to increase motivations.

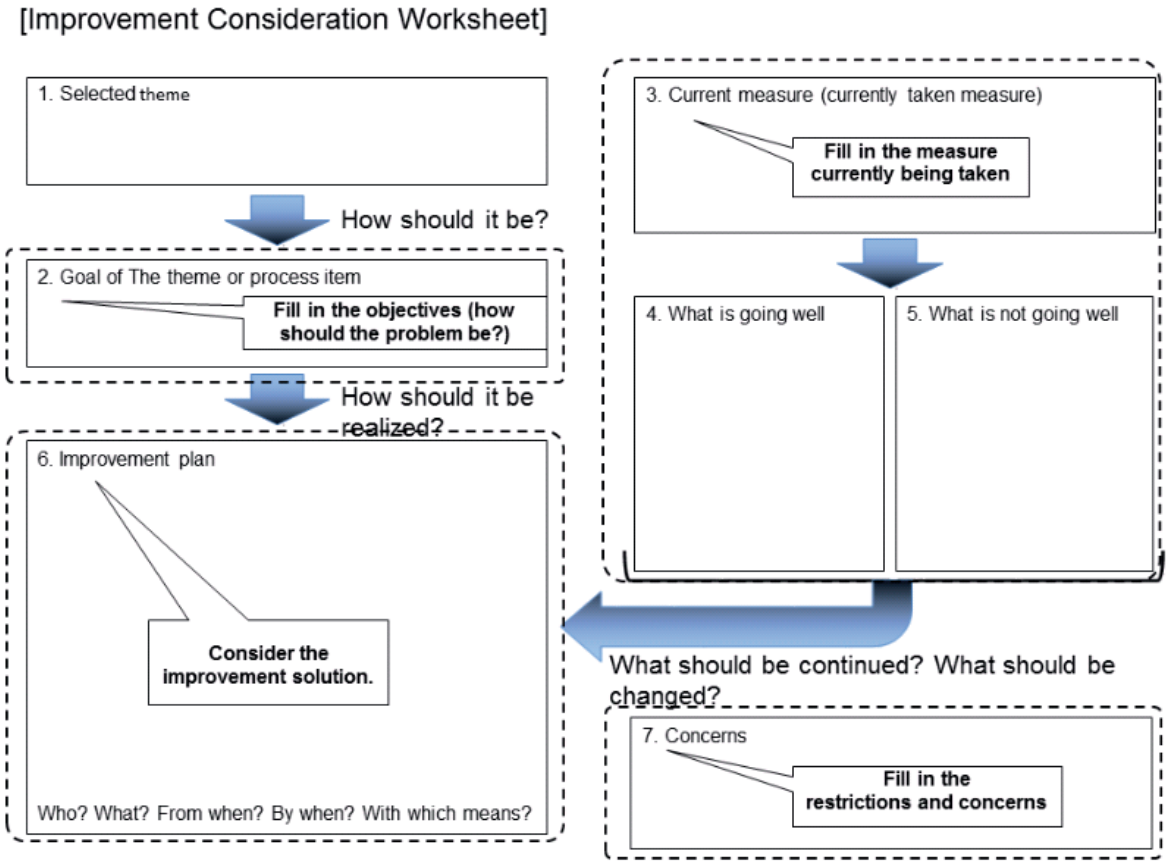

Figure A.7 — Filling in the relevant Study Worksheet

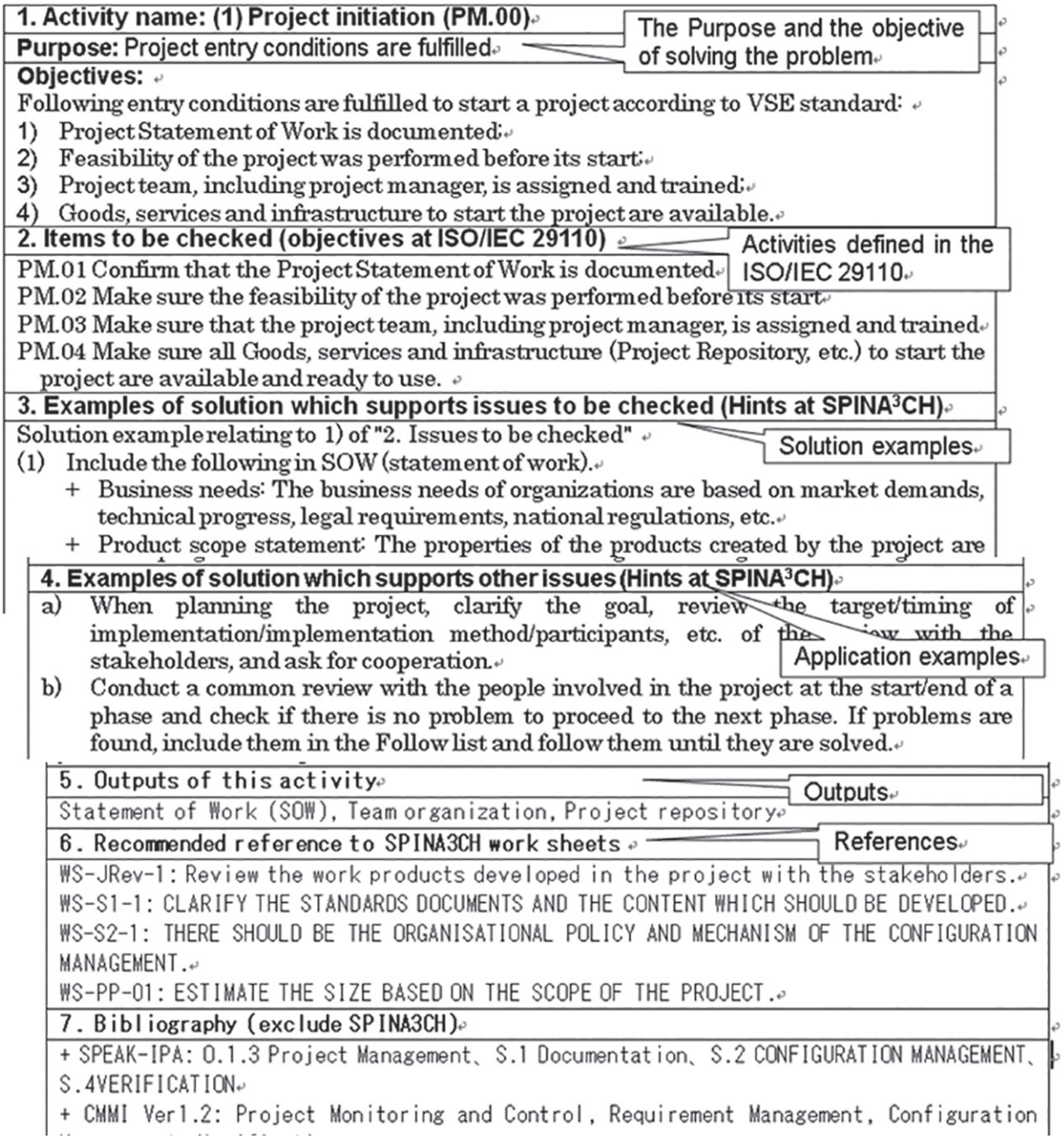

Figure A.8 — Studying the example by themes for the solution by yourself

A.2.6 STEP6: Get a better grasp through discussions

Develop a detailed implementation plans based on Improvement Study Worksheets. You can get better understanding and ideas through discussions with team members and system/software engineering experts. This step contributes to identify practical and feasible improvement plans, which include

— specific actions, efforts,

— improvement objectives, goals,

— schedule (action items, person in charge, date), and

— constraints, reminders, etc.

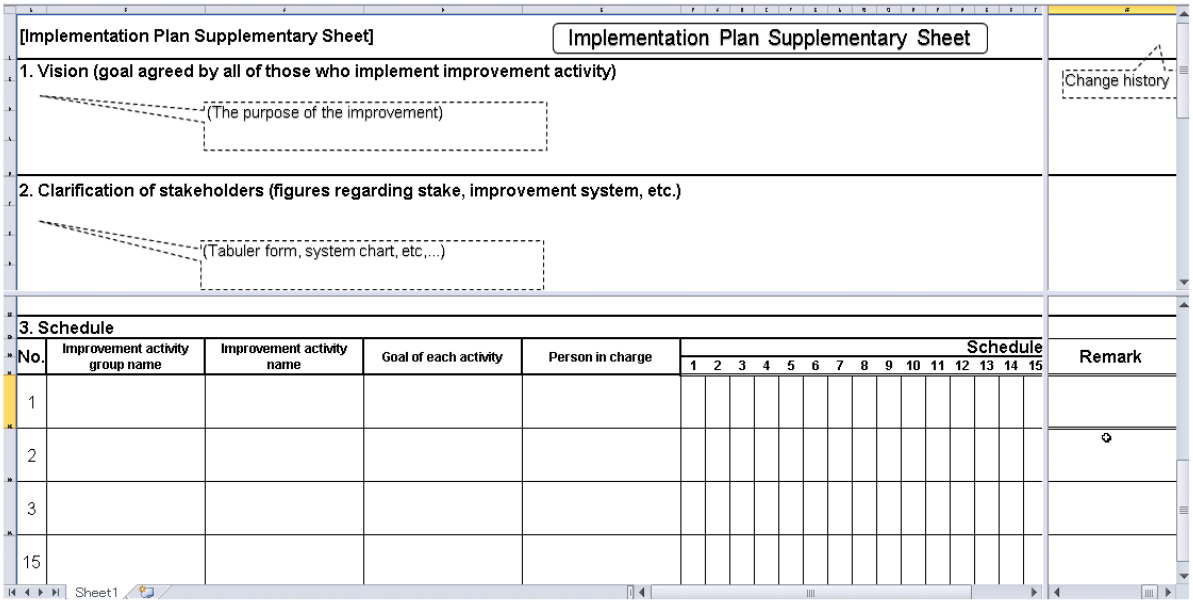

Figure A.9 — Develop a detailed implementation plans based on Improvement Study Worksheet

A.2.7 STEP7: Apply results of study for improvement

Make concrete improvement plans including schedule, roles and objectives. This step contributes to identify organizational intents and players of improvements.

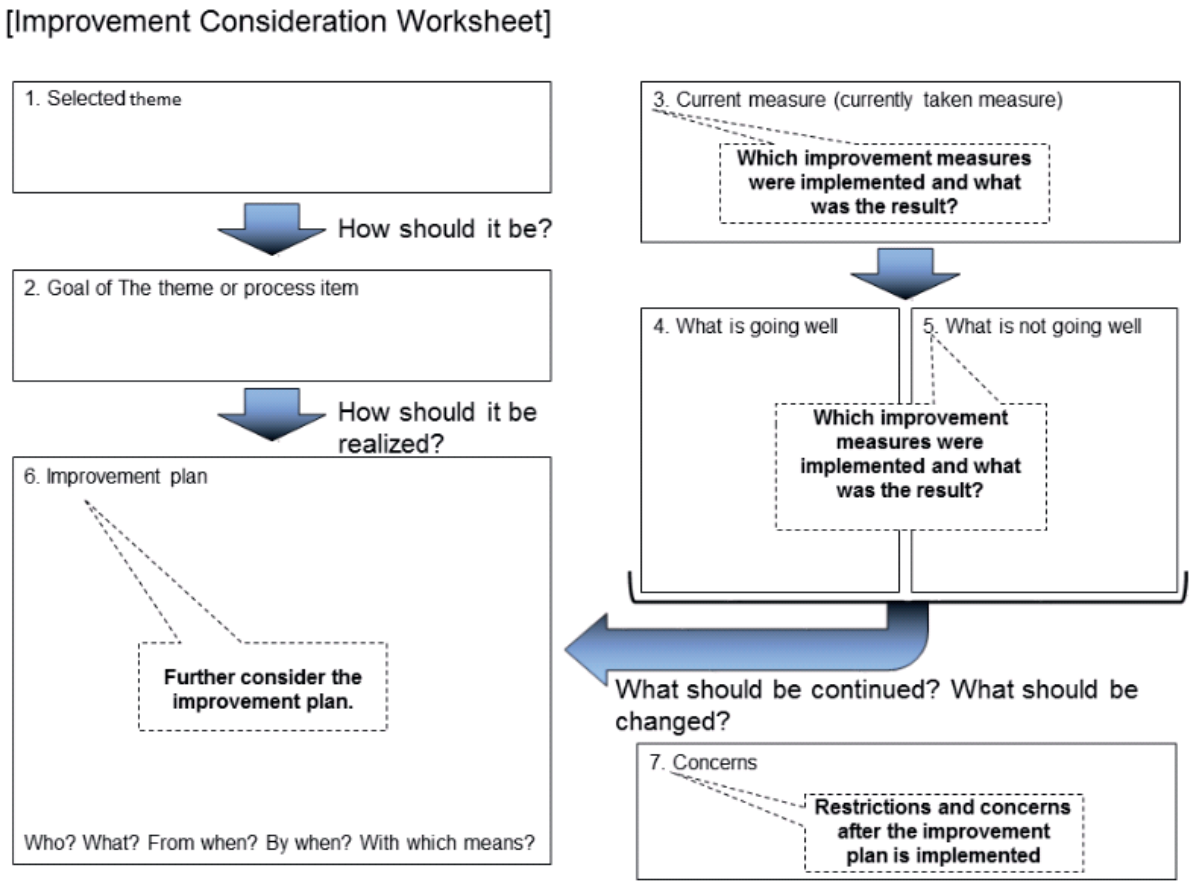

Figure A.10 — Review with Study Worksheet for improvement

A.2.8 STEP8: Conduct review and reflect to the next improvement cycle

Review the improvement activities to find expected/unexpected results from them. Then, recheck the activities through Step1 to 7 and identify the extent how the processes have been improved. This step contributes to clarify performance of improvement activities and to set the next cycle of improvement.

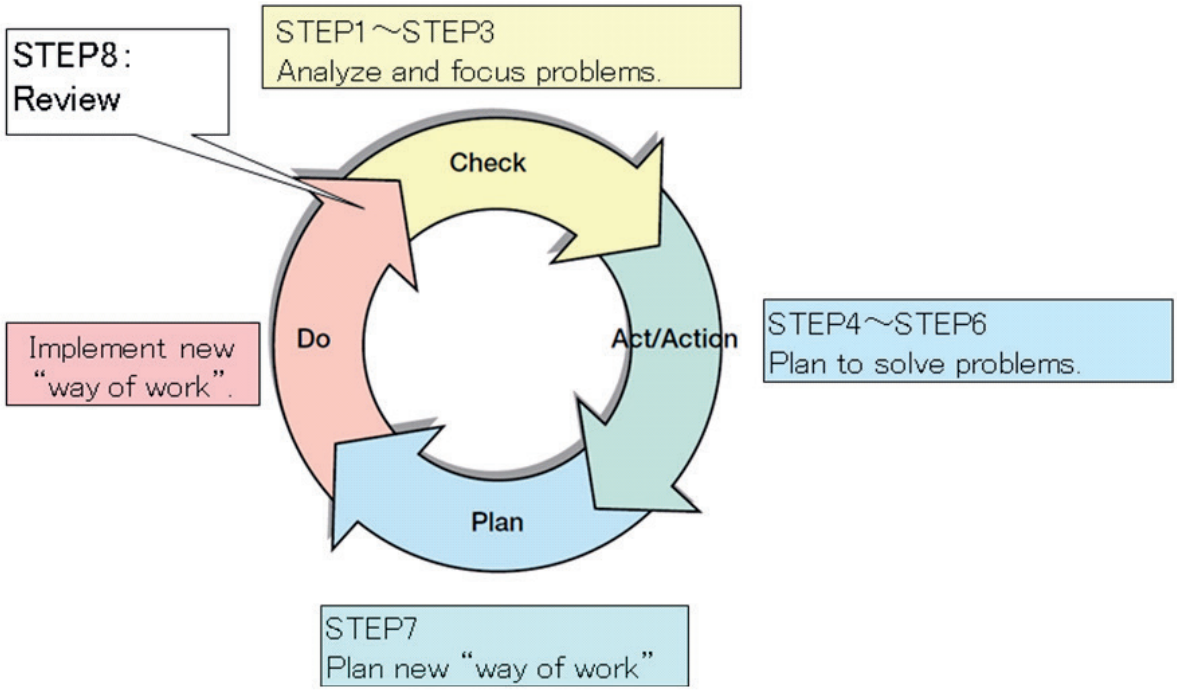

Figure A.11 — Performing the PDCA cycle for the continuous improvement

NOTE PDCA (Plan-Do-Check-Act).

Annex B
(informative)

Adapting various profiles with the SPINA^{3}CH method

B.1 Adapting various profiles with the SPINA^{3}CH method

The SPINA^{3}CH autonomy-based improvement method may be combined with various VSE profiles. As shown in Annex A, the method should use some tools with simplified process models. In Annex B, we show how to plug-in or adopt a specific profile, hereafter the profile X, to the SPINA^{3}CH framework as illustrated in Figure B.1.

The Awareness Sheet uses a simplified process/activity diagram reflecting information flow of the activities/processes attached with problem candidates. This diagram should be made from Process Diagrams in the Engineering and Management Guide for the Profile X. For the Software Basic Profile, in Annex A, we used activities instead of processes. Such flexible problem to profile mapping may be useful. Problem candidates should be developed based on practitioner's interviews, various publications, and/or professional experiences for the domain in Profile X.

The Problem Cards are to describe a problem of concern on each card based on problem candidates.

The Problem Analysis/Focus Sheet is a blank paper on which analysis work should be done, and do not need any customisation.

The Sheet for Software Engineering Themes (Process Mapping) is similar to the Awareness Sheet attached with titles of the Improvement Study Worksheets.

The Improvement Study Worksheets are based on the processes, grouped process outcomes or (grouped) process activities. Their detailed outcomes are based on process outcomes or activity objectives. Best practice examples (solution examples) for that Improvement Study Worksheets should be based on actual best practices or proposed software engineering approaches. This information should be collected and compiled by the developer and/or tool/methodology vendor of this specified SPINA^{3}CH model.

The Improvement Planning Sheet for scheduling may be used as presented with no modification.

Improvement cycle (PDCA cycle) process may be also used as presented with no modification.

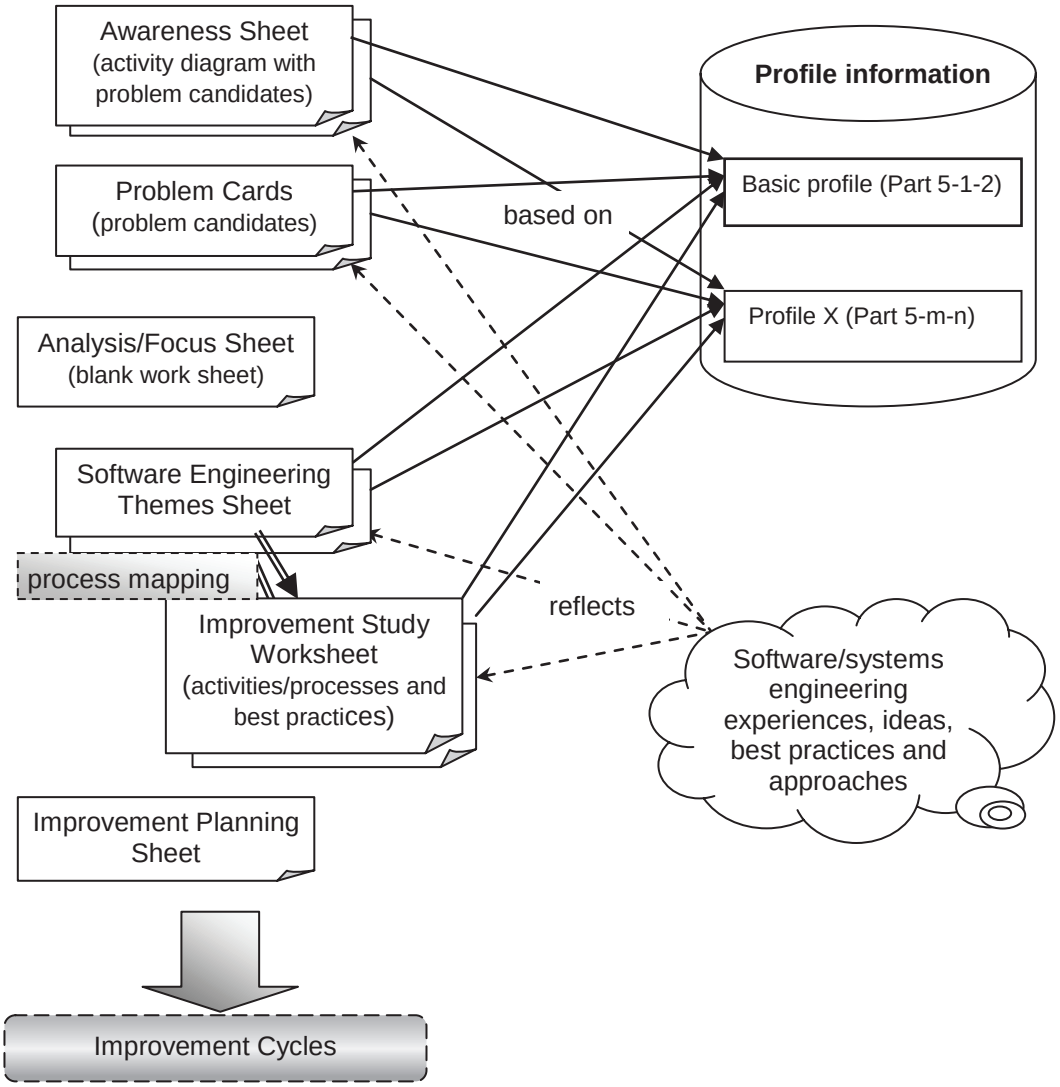

Figure B.1 — Method Concept of adapting various profiles

The interpretation of the diagram notation is as follows: the paper shape represents the sheet; the rectangle represents the profile; the database like shape represents container; the cloud shape represents human thoughts; the round rectangle represents the process; the solid/dashed arrow represents referencing relationship, the double line arrow represents mapping and the thick arrow is flow.

Bibliography

[1] ISO/IEC/IEEE 12207:2015, *Systems and software engineering — Software life cycle processes*

[2] ISO/IEC/IEEE 15288:2015, *Systems and software engineering — System life cycle processes*

[3] ISO/IEC/IEEE 15289:2015, *Systems and software engineering — Content of life-cycle information items (documentation)*

[4] ISO/IEC TR 29110-3, *Software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 3: Assessment guide*

[5] ISO/IEC 29110-4-1, *Software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 4-1: Profile specifications: Generic profile group*

[6] ISO/IEC 29110-4-6[1)], *Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 4-6: System engineering profile specifications: Generic profile group*

[7] ISO/IEC TR 29110-5-1-2:2011, *Software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 5-1-2: Management and engineering guide: Generic profile group: Basic profile*

[8] ISO/IEC TR 33014:2013, *Information technology — Process assessment — Guide for process improvement*

[9] ISO/IEC 33001:2014, *Information technology — Process assessment — Concepts and terminology*

[10] SPINA^{3}CH – Self-determined Improvement Method, Information-technology Promotion Agency, Japan, Software Engineering Center (IPA/SEC) Process Improvement WG, 2011.7 <http://www.ipa.go.jp/english/sec/reports/20120321.html>

[11] PRISMS. an Approach to Software Process Improvement for Small to Medium Enterprises - Pat Allen, Muthu Ramachandran and Hisham Abushama, QSIC '03 Proceedings of the Third International Conference on Quality Software, 2003

[12] Software Process Improvement for Small and Medium Enterprises, Hanna Oktaba, Mario Piattini, Information Science Reference, Apr 16 2008

[13] SPI MANIFESTO. (Version A.1.2. 2010), SPI.net, 2.2010 <www.iscn.com/Images/SPI_Manifesto_A.1.2.2010.pdf>

[14] Software Process Improvement in SMEs: A Comparative View, Deepti Mishra and Alok Mishra, ComSIS vol.6.No.1, June 2009

1) To be published.

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