

# How Small Companies Can Improve their Software Development Processes for Gaining Competitive Advantage

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**Abstract.** Small companies that develop software do have a significant influence on the economy, but most of them do not implement any international standards or models. To solve such difficulties, the ISO/IEC 29110 standard Systems and Software Engineering – Lifecycle Profiles for Very Small Entities (VSEs) is being developed by the ISO community. The structure of the standard is described as well as its key concept which lies in a development of VSE Profiles. By using these Profiles, very small companies have the chance to improve their processes in a clear and stepwise manner. Paper describes advantages of conforming to the standard and issues that the standard deals with. The initiatives aiming at a broader diffusion of the standard in the Czech Republic are presented. It is above all translation of freely available parts into Czech language, publication the standard in the form of easily accessible methodology and building an informational website about ISO/IEC 29110.

**Keywords:** Software Process Improvement, standard, small companies, certification, Czech Republic, diffusion.

**JEL Classification:** M15

## 1. Introduction

The key role of software systems in today's society lies in contradiction to a success of software projects. According to several surveys (Johnson, 2006; Ambler, 2013), the ratio of successful software projects ranges to 60%, while the rest is categorized as challenged or failed.

Software Process Improvement (SPI) represents a way of improving a status of software development. International standards like ISO/IEC 12207 (ISO/IEC 12207, 2008) ISO/IEC 15289 (ISO/IEC 15289, 2006), ISO/IEC 15504 (ISO/IEC 15504, 2004), and ISO 9001 (ISO 9001, 2008) play an

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important role in SPI initiatives as companies are willing to show compliance with common business rules.

However, according to several surveys (Analecto et al, 2004; Laporte et al, 2006) small companies consider implementation of international standards quite difficult as they lack sufficient resources in terms of number of employees, budget and time. To solve such difficulties, the ISO/IEC 29110 standard Systems and Software Engineering – Lifecycle Profiles for Very Small Entities (VSEs) is being developed by the ISO community.

In this paper, the ISO/IEC 29110 standard is presented as an example of software and systems process improvement initiatives focused on small companies. Paper describes advantages of conforming to the standard and issues that the standard deals with. The initiatives aiming at a broader diffusion of the standard in the Czech Republic are presented.

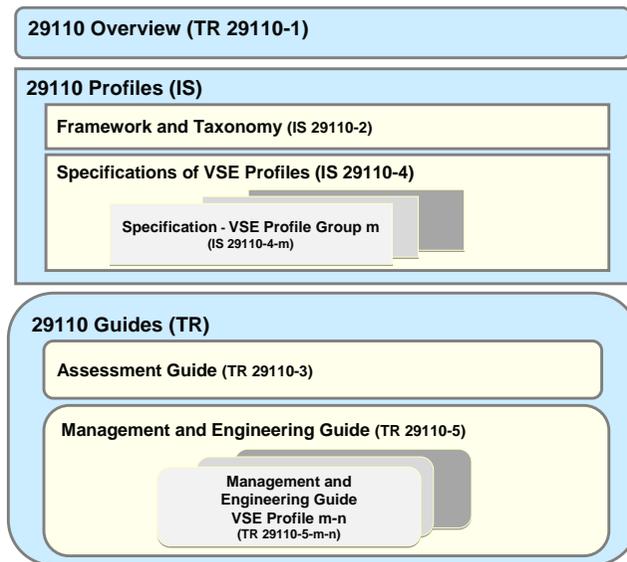
## **2. ISO/IEC 29110 Standard Systems and Software Engineering – Lifecycle Profiles for Very Small Entities**

Although very small companies that develop software have a significant influence on the economy, most of them do not implement any international standards or models like ISO/IEC 12207 or CMMI (Analecto et al, 2004; Laporte et al, 2006). Subsequently, these companies do not have any or very limited opportunities to be recognized as entities that produce quality software and thus are often cut off from contracts. Therefore the ISO/IEC 29110 standard is being developed. The term “very small entity” (VSE) was defined by the ISO/IEC JTC1/SC7 Working Group 24 and consequently adopted for use in the emerging ISO/IEC 29110 standard meaning “an entity (enterprise, organization, department or project) that has up to 25 people”.

### **2.1 Structure of the Standard**

At first Working Group 24 focused on developing a standard in the field of software engineering. Figure 1 shows the standard’s structure. Part 1 Overview (ISO/IEC 29110-1, 2010) explains main concepts, terms and structure of the standard. Part 2 Framework and Taxonomy (ISO/IEC 29110-2, 2010) presents principles and mechanism of building VSE Profiles that

represent a key concept of the ISO/IEC 29110 standard. As a starting point, the “Generic” Profile Group was defined which is applicable to a vast majority of VSEs that do not develop critical software. Within the Generic Profile Group four VSE Profiles were proposed, i.e. Entry, Basic, Intermediate, Advanced. By using these Profiles, very small companies have the chance to improve their processes in a clear and stepwise manner.



**Figure 1** ISO/IEC 29110 Set of Documents (ISO/IEC 29110-1, 2010)

Part 3 Assessment Guide (ISO/IEC 29110-3, 2010) then defines the process assessment guidelines and compliance requirements needed to meet the goal of defined VSE Profiles. This part of the standard is used by certified assessors to perform a VSE assessment. Part 4 Specifications of VSE Profiles provides a mapping to the source standards and is useful for method developers and assessors (ISO/IEC 29110-4, 2010). Part 5 Management and Engineering Guide is intended for VSEs and comprises technical reports for each profile, e.g. Entry profile (ISO/IEC 29110-5-1-1, 2012), Basic profile (ISO/IEC 29110-5-1-2, 2011). First, the Basic Profile intended for a single project with no special risks or situational factors was developed and published. In this Profile, two processes, i.e. the Project Management process and the Software Implementation process are defined.

The purpose of the Project Management process is to establish and carry out the Tasks of the software implementation project in a systematic way, which allows complying with the project’s Objectives in the expected

quality, time and cost range. The purpose of the Software Implementation process lies in the systematic performance of analysis, design, construction, integration and test activities within projects aimed at new or modified software products according to the specified requirements (ISO/IEC 29110-5-1-2, 2011).

As particular pilot projects of Basic Profile implementation in VSEs showed, this Profile was still for some companies difficult to implement. For this reason, the Entry Profile was developed (ISO/IEC 29110-5-1-1, 2012) which applies to six person-months effort or start-up VSEs. The Entry and Basic Profiles are published by ISO and can be utilized. The other two Profiles are still under development. The Intermediate Profile is intended for VSE which handles more than one project at a time, and therefore is aware of assigning project resources and monitoring projects to accomplish business objectives and customer satisfaction. Lastly, the Advanced Profile is proposed to supply business management practices.

To help VSE with an implementation of the Entry and Basic Profiles, a series of Deployment Packages were developed and offered free of charge (Deployment Packages repository, 2015). A Deployment Package acts as a detailed methodology that guides a company through the process of profile implementation. A typical Deployment Package includes process descriptions, activities, tasks, roles and products, templates, checklists, examples, reference and mapping to standards and models, and a list of supporting tools.

## **2.2 Current Development of the Standard**

Resulting from a positive experience with ISO/IEC 29110 implementation in the field of software engineering a set of systems engineering standards for VSEs is being developed.

Within the software engineering area, Part 3 of the standard used for assessment and certification carries on with its elaboration. A standard for Conformity Assessment (29110-3-2) and also for Capability Assessment (29110-3-3) is being composed. Brazil has been the country to lead the development of an ISO/IEC 29110 certification process. Regarding an auditor role within the certification process, an ISO/IEC 29110 auditor should be competent in auditing techniques, have expertise in ISO/IEC 29110 and

experience in systems or software development. For VSEs, such a certification should not be too expensive and long-lasting. This certification process has successfully been piloted in several Brazilian VSEs. The process took about 4 man-days of auditor's work. The first auditor course was conducted in English in Dublin in November 2013 (Laporte and O'Connor, 2014).

Currently, the ISO/IEC 29110 standard is being restructured and renumbered to better correspond to a categorization of systems engineering and new methods and technologies such as agile development and cloud computing. The Working Group 24 has also initiated several activities in the area of services and considers developing a subset of the ISO/IEC 20000 standard for VSEs.

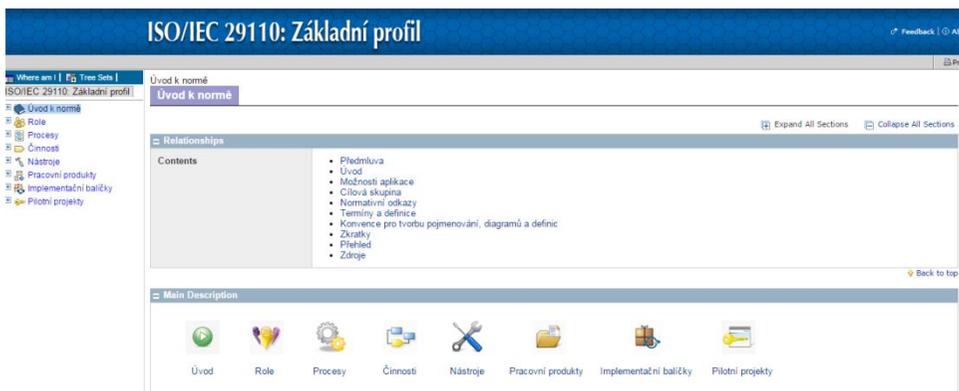
### **3. Initiatives towards a Diffusion of ISO/IEC 29110 Standard in the Czech Republic**

Quality oriented process approaches and standards are still maturing and gaining acceptance in many companies worldwide. However, the status in the Czech Republic is worse. The survey conducted in 2006 and described in (Buchalcevova, 2009) showed that the use of agile methodologies and approaches in the Czech Republic was only at its starting point. More recent survey conducted at the conference WebExpo 2011 (Buchalcevova, 2013; Mittner and Buchalcevova, 2014) showed that while modern software development practices and methodologies especially agile are applied to a large extent, international or national standards and models are practically not implemented. However, the respondents indicated a belief that by using right methodologies, standards and tools it is possible to improve their software processes.

I personally believe that the use of international standards in companies in the Czech Republic represents a key factor in their competitiveness within the global market. Applying these standards enhance software management, enable meeting deadlines and budgets, achieving quality goals, managing employee training and turnover. Moreover it attracts new customers and fulfills requirements of existing partners and reinforces partnerships and co-development in an international environment.

As a member of the working group WG24, I have participated in the ISO/IEC 29110 standard development since 2008. Thus, I have the opportunity to track how small companies in other countries such as Brazil, Mexico or Thailand widely implement the ISO/IEC 29110 standard largely supported by the governments. However, the Czech Republic lacks such a government support aiming at improved process quality in systems and software development. Moreover, the government does not even require a certain level of these processes e. g. in government contracts. Thus, companies in the Czech Republic need to care themselves about quality of their processes and products.

As education of future developers is an important prerequisite for increasing process quality in software development in practice, I incorporated this standard into university courses at the Prague University of Economics on the undergraduate as well as graduate level. As key parts of the standard are available for free, it was able to translate them into the Czech language. We did it with the assistance of students taking the graduate course Software Process Improvement. Students also translated and updated all Deployment Packages. We developed website <http://spicenter.vse.cz/> where all these resources are published. Moreover, two students within their diploma theses implemented Entry and Basic profiles in the Eclipse process framework composer tool and published them in the form of easily accessible methodology which is part of the website (see Figure 2).



**Figure 2** Basic Profile in EPFC tool

In addition, we also translated the Wikipedia page about this standard into Czech which is accessible at [http://cs.wikipedia.org/wiki/ISO\\_29110](http://cs.wikipedia.org/wiki/ISO_29110). I

have also prepared a public course about the ISO/IEC 29110 standard opened for general public. Currently, the Faculty of Informatics and Statistics of the Prague University of Economics is in the process of building the Center for Very Small Entities in the Czech Republic as a part of the netcenter for VSE – the global net of centers for very small entities.

## 4. Conclusion

Although very small companies that develop software have a significant influence on the economy, most of them do not implement any international standards or models, as they lack sufficient resources in terms of number of employees, budget and time. The situation in the Czech Republic in the area of international standards implementation looks even less promising. To address this global issue, the ISO/IEC 29110 standard “Systems and Software Engineering – Lifecycle Profiles for Very Small Entities (VSEs)” is being developed by the ISO community. This paper described concept of the standard and its evolution and presented the initiatives undertaken towards a broader diffusion of the standard in the Czech Republic.

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