

On Project Management Process in Agile Systems Development Methodologies and the ISO/IEC 29110 Standard (Entry Profile)

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Abstract. The use of ISO/IEC systems and software engineering standards is recommended for software development organizations. In particular, in 2011, a new software process standard was released for Very Small Entities (VSEs): ISO/IEC 29110. Furthermore, the Agile-based System Development Methodologies (SCRUM, XP, Crystal, among others) have also gained interest by organizations. In this - in progress- research, we present an overview of the ISO/IEC 29110 standard, as well as of the Agile-based SDMs, and propose that such SDMs can be enhanced with recommendations from the ISO/IEC standard. In particular, we focus on the Project Management process – one of the two essential processes in the ISO/IEC 29110 standard – and its potential support through a Deployment Package (DP). A DP can be considered an electronic process guideline, and it is attempted to facilitate the implementation of the standard in a VSE.

Keywords: ISO/IEC 29110, Agile Methodologies, VSEs, Deployment Package, EPG, Project Management

1 Introduction

For many small and very small software development companies, implementing properly controls and methods for managing their software development is a big challenge. All software companies are not similar and they change according with many factors such as: size, market sector, time in business, management style, location, and type of provided services and products. This fact, company diversity, remarks important points for those who develop software process and process improvement models or standards [7]. At present time, software quality is a key variable to competitive advantage, and the use of ISO/IEC systems and software engineering standards are becoming important for many software development organizations. However, most of these companies do not have the technical expertise or the required resources (e.g. sufficient number of employees, financial ones, and allowable time by customers) for implementing them. Additionally, it has been reported that small and very small software development enterprises reject its implementation (of international standards) by the negative perception on that they have been developed for large companies [7]. Consequently, small and very small software development companies lose all benefits that software process international standards or models can provide them, and lately their customers and this market also suffers of a high variability in the quality, costs and time core metrics of their software projects.

Nowadays, many countries distinguish the importance of the VSEs for their economies [6]. The lack of delivering a quality product on time and within budget threats –thus-, the competitiveness of these types of small or very small companies, and finally affects economic parameters. Several international standards or models like ISO/IEC 12207 and CMMI have been developed to collect the best software engineering and managerial practices, but they were not developed for small or very small businesses, so their implementation is inhibited in VSEs. Consequently, despite the potential initial interest in implementing well-defined processes (and supported by international standards or models) in VSEs, it has also identified a high resistance to adapt such standards or models to the needs of business and demonstrate its application in practice [7]. Thus, VSEs have negative perceptions about such software process models or standards by negative views of required additional cost, documentation and bureaucracy issues.

Fortunately, in 2011, a new software process standard was released for VSEs: the ISO/IEC 29110. This standard is formed by two types of processes: Project Management and Software Implementation. It should be noted that ISO/IEC 29110 standard defines the minimum activities and work products that require VSEs to perform [9].

In particular for Mexico country, the effects of globalization demand a better management of the business processes of an organization. Therefore, Information and Communications Technologies (ICT) services in Mexico have increased exponentially in recent years according to ProMéxico [13]. The ICT services market reached 793,000 million dollars worldwide in 2010, while in Mexico the same item reached an amount of 3,988 million dollars in the same period [13]. According to the same study, Mexico is the best destination in Latin America to establish IT companies. Mexico is ranked 6th behind only from India, China, Malaysia, Egypt and Indonesia countries [13].

Thus, the opportunities and needs are wide in Mexico to robust the software development industry.

2 State of the Art

2.1 ISO/IEC 29110 Life Cycle Software Development for VSE (Very Small Entities) Standard.

In January 2011 a new standard for Life Cycle Software Development for VSE (Very Small Entities) was released internationally: ISO/IEC 29110. This standard provides a lightweight process model developed for organizations classified as very small entities (VSEs employs from 1 to 25 people) [9]. ISO/IEC 29110 provides a standard according to VSEs characteristics and needs. The ISO/IEC 29110 has two main categories of processes: Project Management and Software Implementation (see Fig. 1, adapted from [11]).

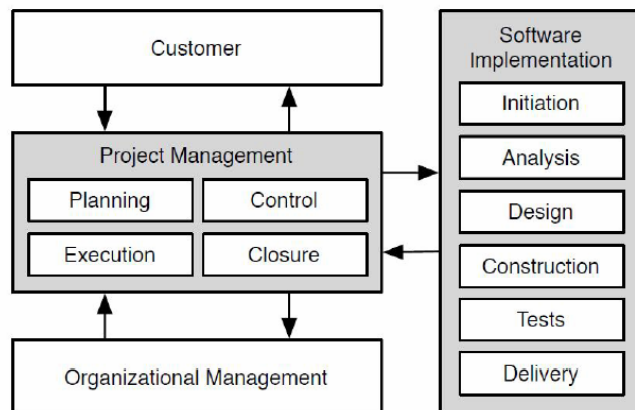


Fig. 1. Structure of the ISO/IEC 29110 Standard [11].

The main features of the two sides of previous model are as follows:

- Project Management (PM) aims to establish and carry out the tasks of the software implementation, which will fulfill the objectives of the project according to quality, time and expected costs. PM includes four activities: ***planning, control, execution and closure***.
- Software Implementation (SI) aims to systematically analyze, design, construction, integration and testing of software products processed according

to specified requirements. SI includes six activities: *initiation, analysis, design, construction, tests and delivery*.

The ISO/IEC 29110 standard provides several support documents of the software lifecycle, guidelines standards and technical reports for VSEs [11]. These documents are based on a subset of items which are known as profiles VSEs. The purpose of a profile is the definition of a subset of best practices from relevant international standards in the context of VSEs [11]. At present, there have been proposed four profiles: *entry, basic, intermediate and advanced*, but only the first two have been released. In this doctoral research, we will focus in the first “*entry profile*” [5].

It can be identified slight differences between the two first profiles of ISO/IEC 29110 (entry and basic) in three issues: **benefits, entry conditions, and rigor of management project process**. According to ISO/IEC 29110-5-1-1 Entry Profile and ISO/IEC 29110-5-1-2 Basic Profile documents, fewer benefits can be reached with the Entry Profile than with the Basic Profile, and more entry conditions and project management rigor are asked in the Basic Profile than in the Entry Profile [4].

2.2 Agile-based Systems Development Approaches

Agile-based systems development approaches contrast strongly to traditional plan-based approach in software engineering practices [3]. These methods recently are emerged as a new and different way of developing software as compared with others “more traditional” ones[2]. However, the success of these agile methods cannot be reached directly without a set of required factors such as: organizational development strategy, a well-defined process, and a competent development team (implied by an adequate training on the used agile method). [2]. In 2001 the “agile” objective was to determine the value and principles that should allow the team to develop software quickly and responding to changes that arise in project [1]. These new methods were considered as an alternative to traditional development software processes, characterized as rigid and bureaucratic [1].

Several agile methods have been proposed. These are: SCRUM, XP, and Crystal Methodology, among others [3]. According to [10], there has been a growing positive trend of utilization of agile methods by software development companies in the last 5 years. Also, more organizations are adapting their software development processes to agile conventions and adopting them in many workplaces. Some works teams are combining agile and non-agile techniques and practices to create a hybrid methodology. According with some companies who have successfully adopted agile methods, the benefits are well worth the effort.

2.3 Deployment Packages

“A *deployment package is a set of artifacts developed to facilitate the implementation of a set of practices, of the selected framework, in a VSE*”. However, a Deployment Package is not a process reference model [6]. A Deployment Package must contain the following elements: process description (activities, inputs, outputs and roles), guides, templates, checklists, examples, presentation materials, references and mapping to standards and models, and list of tools. Additionally this research [6] indicates that “*packages are designed such that a VSE can implement its content, without having to implement the complete framework at the same time*”. It implies that a Deployment Package for the ISO/IEC 29110 does not need to include all of its elements, but rather it is a customized true and fair interpretation of the standard [6]. Fig. 2 displays the general content structure suggested for a DP for the ISO/IEC 29110.

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1. Technical Description
 - Purpose of this document
 - Why this Topic is important
 2. Definitions (Generic and Specific Definitions)
 3. Relationships with ISO/IEC 29110
 4. Detailed Description of Processes, Activities, Tasks, Steps, Roles and Products
 - Role Description
 - Product Description
 - Artefact Description
 5. Templates
 6. Examples
 7. Checklists
 8. Tools
 9. Reference to Other Standards and Models (ISO/IEC 12207, ISO 9001, CMMI for Development)
 10. References
 11. Deployment Package Evaluation Form

Fig. 2. Content official of a Deployment Package [6]

Thus, a Deployment Package can serve us as guidelines and support implementation documents to conduct pilot projects in VSEs [5].

2.4 VSEs (Very Small Entities).

A VSE is defined like an enterprise or project having up to 25 people. The VSEs has great value due to the contribution of services and/or products which are used in large systems and hence the quality of software is required [9]. The Organization for Economic Cooperation and Development (OECD) produced a report in 2005 in which Small and Medium Enterprises (SMEs) are key part of business organizations of all countries of the world, being from the 95% and 99% of the total depending on the country [12].

Also, in July 2005, a survey was applied to 68 managers of companies in the software industry in Mexico. The results of this study revealed that 54.41% of the Mexican software industry are micro size (1-10 employees). For other side, the same study showed that 47% of that enterprises are emergent. In this case (our protocol and study) considers VSEs with a maximum of 5 participants by project [8]. Furthermore, the VSEs have differences compared with a large business [6]. In Fig.3, these characteristics are reported:

Characteristic	Small firm	Large firm
Planning orientation	Unstructured/operational	Structured/strategic
Flexibility	High	Structured/strategic
Risk orientation	High	Medium
Managerial process	Informal	Low
Learning and knowledge absorption capacity	Limited	High
Impact of negative market effects	More profound	More manageable
Competitive advantage	Human capital centered	Organizational capital centered

Fig. 3. Differences between Small and Large Companies [6].

3 Research Plan and Methodology

The research objective – of this in progress doctoral research - is to design and empirically validate an ISO/IEC 29110 Deployment Package (for Project Management Processes, Entry Profile) based on Agile-based system development approaches. Four research questions and null research hypotheses have been stated as follows:

1. ¿ What should be the detailed structure of a framework for assessing the compliance to the standard ISO/IEC 29110 (Project Management, Entry Profile) by agile software development methodologies that be accepted as theoretically valid by a panel of PhD experts ?

- a. H0. There is not a valid theoretical framework for this aim.
2. ¿What is the level of compliance to the ISO/IEC 29110 (Project Management, Entry Profile) for the best 3 agile software development methodologies proposed in the literature standard software?
 - a. H0. The level of compliance to the standard is very low (1) or low (2) (in a 5-point scale from 1 (very low) to 5 (very high)).
 3. ¿What are the structural changes and additions required to the selected agile software development methodology, in order to fit the ISO/IEC 29110 standard (Project Management, Entry Profile)?
 - a. H0. None structural changes or additions are required for this aim.
 4. ¿What are the perceived values of usefulness, ease of use, compatibility, value, normative beliefs, and intention of use, on the elaborated ISO/IEC 29110 Deployment Package (Project Management, Entry Profile) on the selected agile software development methodology, by a pilot sample of international professionals and academics in Software Engineering?
 - a. H0. The perceived values of usefulness, ease of use, compatibility, value, normative beliefs, and intention of use will be less than or equal to 3.0 on a Likert scale of 1 (low) to 5 (very high).

The research method can be defined as Conceptual Design with Proof of Concept [14, 15]. Its four phases are: (i) Formulation of Research Problem; (ii) Analysis of Related Work; (iii) Development of the Conceptual Design; and (iv) Conceptual Design Validation (empirical proof of concept). In phase (i), the background and history of the problem, the problematic situation, the type and purpose of research, the relevance, and the objectives, questions and hypotheses are reported. In phase (ii), analysis of related work, theories bases, related studies, contributions and limitations of related studies, selection/design of general conceptual framework, selection/design model of research are reported. In phase (iii), application or conceptual model or design (deployment package), application or creative-deductive relational conceptual design model are reported. In phase (iv), conceptual model validation implemented or design, validation of content by panel of experts, validation by logical argument, validation for proof of concept construction artifact are reported.

4 Conclusions and Directions for Future Research

This research is focused to study a recent and very important problem for the VSEs. It can be considered a relevant research problem according with the reviewed literature. This study will focus on the design and validation of a Project Management Deployment Package considering the ISO/IEC 29110 (entry profile) official recommendations for enhancing the Project Management process used in Agile

Methodologies like: SCRUM, XP, and Crystal. The final product (the DP) will be empirically validated through a pilot sample of software engineers professionals from several countries (Mexico, Ireland, and USA). Hence, it is important to note that our specific research topic has been little investigated. However, it is essential for VSEs because it generally accepted that organizations that use better software development processes will be more competitive. We believe that an **ISO/IEC 29110 Deployment Package** can help to improve the Agile Software Development approaches –in particular the Project Management processes-.

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