

PRIORITIZATION OF PROCESSES FOR SOFTWARE PROCESS IMPROVEMENT IN SMALL SOFTWARE ENTERPRISES

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Abstract: In this article a set of processes which are considered to be of high-priority when initiating the implementation of a Software Process Improvement –SPI– project in Very Small Software Enterprises –VSEs–, is presented. The objective is to present the VSEs with a strategy to deal with the first processes that must be considered when they undertake an SPI project. The processes proposed in this article are fundamentally based on the analysis and contrast of several pieces of research carried out by the COMPETISOFT project. The fundamental principle of the proposal is that process improvement must be connected with the other software process management responsibilities.

1 INTRODUCTION

From the beginning of the 21st century onwards, the Software Engineering community (industry and researchers) has expressed a special interest in Software Process Improvement –SPI– for Small Software Enterprises –VSEs–. Interest in SPI in VSEs is growing due to the fact that these companies are an extremely important cog in the gears of the economy of many nations in the world. The software industry in most countries has an industrial backcloth, made up mainly of small software organizations which favour the growth of national economies. In order to fortify this kind of organizations, efficient strategies, practices and/or guides to tailor software process improvement to their size and type of business are needed.

Currently, the COMPETISOFT project is being developed. This project deals with the creation of the software reference process, assessment and improvement models adapted to the characteristics of the software industry in Latin America. One of the strategies of the COMPETISOFT Project is to

carry out theoretical and/or practical studies in the area of SPI for VSEs, which provide information in order to attain more elements of judgement and to thus facilitate the adoption and implantation of international or regional standards related to SPI in VSEs. In this article a set of processes which are considered to be of high-priority when initiating the implementation of a project SPI in VSEs, is presented. The objective is to present the VSEs with a strategy to deal with the first processes that must be considered when they undertake an SPI project.

The paper proceeds as follows. In Section 2 related works are presented. The high-priority processes are shown in Section 3 and 4, and finally, our conclusions and future work are outlined.

2 RELATED WORKS

There are various related works that present a set of processes which VSEs could use to derive significant benefit from process improvement. These include:

- MoProSoft (Oktaba, 2005) proposes 6 processes (based on ISO 12207, CMM).
- MPS.BR (Weber et al., 2005) proposes 23 processes (based on ISO 12207 and CMMI).
- RAPID (Cater-Steel et al., 2005) proposes 8 processes (based on ISO 15504:1998).
- PROCESSUS (Horvat et al., 2000) proposes 6 processes (based on CMM and ISO 9001).
- ADEPT (McCaffery et al., 2006) proposes 12 processes (based on CMMI).

The main contribution that this work pretends to make in the area of SPI in VSEs is to propose and prioritize several reference processes based both on the VSEs' special characteristics and on the existing literature dealing with SPI. Prioritization of processes allows VSEs to be guided in the question of which practices should be carried out first at the beginning of an SPI project, regardless of the process reference model used. It is important to emphasize that this work wishes to explain to VSEs which processes to tackle at the beginning of an SPI project. The description of the processes as well as their results, conclusions, practices, inputs, etc., are available in process reference model material such as MoProSoft, MR-MPD de MPS.BR, RAPID, PROCESSUS, ADEPT, ISO/IEC 12207, CMMI.

3 SELECTION OF PROCESSES

The processes proposed in this article are fundamentally based on the analysis and contrast of three research works carried out by the COMPETISOFT project:

- **An exploration of the background of software process practices in the south-western Colombian software industry** (Hurtado et al., 2006). From this research work we can see that companies are more interested in the implementation of disciplines related to the Engineering Process Group (requirement elicitation, analysis and design, software construction, testing and software installation). The companies are less interested in disciplines related to the Management Process Group (planning, tracking and control) and to the Support Process Group (quality assurance, configuration management and requirement management).
- **A systematic review of software process improvement in small software enterprises** (Pino et al., 2006). From this research work we can see that companies are more interested

in improving: (i) the processes of project management related to the management process group; and (ii) the documentation processes, change request management and configuration management related to the support process group. Companies do not appear to show much interest in carrying out improvements to the engineering process group, with the exception of the requirement elicitation process.

- **An analysis of the contribution of international standards to the management and improvement of software process** (Pino et al., 2007). As this work is related to the area of software process improvement, it is important to express a special interest in the processes which are strongly connected to the responsibility of improving processes: (i) organizational alignment and measurement related to the management process group, and (ii) process establishment, process assessment and process improvement related to the Process improvement process group. It is essential to bear in mind that process improvement is immersed in process management.

The processes that are proposed as high-priority in the implementation of a software process improvement programme in small software enterprises are described in Table 1. With the aim of expressing these processes in terms of an internationally recognized reference model, the nomenclature of processes and groups of process defined in the ISO/IEC 15504-5:2006 standard, is followed. This standard has been chosen because its process group has a greater degree of detail.

Table 1: Processes proposed to begin SPI in VSEs.

ENG — Engineering Process Group	ENG 1. Requirements elicitation	
	ENG 2. System requirements analysis	
	ENG 3. System architectural design	
	ENG 4. Software requirements analysis	
	ENG 5. Software design	
	ENG 6. Software construction	
	ENG 7. Software integration	
	ENG 8. Software testing	
	ENG 11. Software installation	
	ENG 12. Software maintenance	
	SUP — Support Process Group	SUP 1. Quality assurance
		SUP 7. Documentation
SUP 8. Configuration management		
SUP 10. Change request management		
MAN — Management Process Group	MAN 1. Organizational alignment	
	MAN 3. Project management	
	MAN 6. Measurement	
PIM — Process Improvement Process Group	PIM 1. Process establishment	
	PIM 2. Process assessment	
	PIM 3. Process improvement	

The processes displayed in the previous table are organized into process groups, which have been selected according to the results of the research shown previously. For the selection of these processes the following issues have been considered:

- The engineering process group with the aim of improving and complementing the technical disciplines (analysis and design, software construction, etc) which are those most frequently carried out by VSEs. The intention is to consolidate this area in order to guarantee the responsibilities to be carried out by following the best practices proposed by a reference model. It is necessary to place great emphasis on requirement elicitation because it is a discipline that tends to be implemented and improved.
- The processes of project management, documentation, change request management, process establishment, configuration management and quality assurance. These processes have been the subject of many improvement attempts by SPI efforts carried out in VSEs. These processes also contribute to the support of control process responsibility within software process management.
- The processes of organizational alignment, measurement, process establishment, process assessment and process improvement, because these practices are closely related to the responsibilities of defining, measuring and improving processes within software process management.

4 PRIORITIZATION OF PROCESSES

According to (Derniame et al., 1999) the emphasis on processes and on process management provides the main justification for many standardization initiatives, such as CMMI, SCAMPI, ISO/IEC 15504, ISO/IEC 12207 (in addition to the efforts of measuring process capability) and therefore for other proposals based on the philosophy of these standards. Process improvement, following the conception of measuring its capability, is based on statistical processes control. Statistical processes control is based on the management process and its four key responsibilities: improve the process, define the process, measure the process and control the process. It is also important to emphasize that process improvement is immersed as a responsibility

within software process management (Florac et al., 1997).

On the other hand, VSEs are generally created as the result of having carried out a successful project. In fact, in these organizations the process is carried out in an innate way. The process is born with the organization although it is neither defined nor visible. These organizations start their operation by carrying out technical processes, which is an inherent responsibility of the project management. According to the information presented in (Hurtado et al., 2006) and (Pino et al., 2007) there is a high risk that VSEs will never cease to carry out technical processes, and evidence of this is: (i) their interest in implementing these processes and (ii) the improvements introduced into these kind of companies are concentrated on project management. Project management is responsible for ensuring that a software product is developed according to a plan and that that plan is feasible.

Therefore it is fundamental that, through software process improvement, the enterprises can carry their processes from process execution and project management up to the establishment of the four software process management responsibilities. We propose that process groups should be prioritized by setting up the process groups in the following order:

- The process improvement process group.
- The management process group.
- The support process group.
- The process engineering group.

Once the SPI programme has been established in the VSE, the first step is to follow an iterative and incremental improvement process (for instance, PmCOMPETISOFT (Vidal et al., 2006)). The improvement process guides the creation (or improvement) of processes within the VSE, with the objective of creating a basic infrastructure for software process management at the first iteration. This infrastructure is based on the following processes: process improvement, process establishment, process assessment, organizational alignment, project management, and measurement. With the improvement or creation of these processes and their later execution within the VSE, responsibilities such as defining, measuring, and improving the process are supported.

The following step is to use a second improvement project iteration to set up the processes related to the support process group. Besides being those that the majority of VSEs look to improve, these processes also help to support and deal with

the responsibility of controlling the process. Process control tries to make results predictable, which means keeping the process within its normal inherent limits of operation.

Finally, practices relating to the engineering process group must be established through more improvement project iterations. It is also possible to include other processes determined by the organization's business objectives.

5 CONCLUSIONS AND FUTURE WORKS

This article has proposed and prioritized a group of processes with which to guide VSEs as they begin an SPI project. The process selection and prioritization which has been carried out was based on the fact that process improvement is not an isolated activity, but is closely related to process management.

The fundamental principle of our proposal is that process improvement must be connected to the other process management responsibilities. Having taken this into consideration, an SPI in VSEs project must first establish a basic infrastructure related to the responsibilities of the process management. This is the reason why the first processes to be established must be those in the improvement and management group, with the objective of creating the ring of Improve-Define-Execute-Measure necessary for process management. The second step is to include the control process through the support process group. Finally, engineering process improvement must be carried out. It is important to emphasise that the establishment of this infrastructure in itself implies process improvement within the VSE.

Our future work is to apply this proposal in order to refine and validate it. This application will be made to different process improvement projects that will be carried out in the Latin American companies involved in the COMPETISOFT project.

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