A SMALL SETTINGS CASE STUDY USING TSPI
IN A SOFTWARE PROJECT

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Abstract: *This article introduces a small setting case study about the benefits of using TSPi in a software project. An adapted process from the current process based on the TSPi was defined. The pilot project had schedule and budget constraints. The process began by gathering historical data from previous projects in order to get a measurement repository. The project was launched with the following goals: increase the productivity, reduce the test time and improve the product quality. Finally, the results were analysed and the goals were verified.*

Keywords: *TSPi, Small Settings, Process improvement.*

ACM Classification Keywords: *D.2.9 Software Engineering – Management, software process models*

Introduction

Large and small and medium enterprises have common problems related to the management and quality [IPRC, 2006] of software projects. This generates costs overruns, low quality and cancelled projects [Standish Group, 2004].

Some processes models like the CMMI are successful enough, but they are not affordable for the small organizations [IPRC, 2006].

Organizations have recognized that the control of their software processes affects the success of their projects, *"they know what to do but not how to apply it"* [Noopur, 2003].

A new research line based on the process improvement in small settings is arising in order to facilitate competitive capabilities for this environment in a global market [Glazer, 2006]. Small Settings include small and medium organizations, and small software projects [Garcia 2006].

Garcia [Garcia, 2005] and Serrano [Serrano, 2006] show how to get CMMI maturity levels using TSP in Small Settings. Some CMMI level 5 organizations have improved their quality levels using TSP [Noopur, 2003].

Team Software Process (TSP) is a framework that provides a customizable process based in an excellent experience in planning and managing software projects [Humphrey, 2006]. It guides teams in managing cost, schedule and quality [Noopur, 2003].

This article shows through a case study the results of using an adapted process based on the introduction of the Team Software Process (TSPi) in a small organization.

The following goals have been established for the adapted process:

1. To finish the project within the established schedule, cost and effort.
2. To reduce the test time.
3. To increase the productivity and improve the product quality.

The organization decided to use TSPi in order to accomplish the previous goals assuming the risk of modifying its previous processes. Besides, there was not enough time or resources to elaborate a complete training in TSPi and PSP.

Therefore, the organization decided to apply the basic TSPi principles, getting a customized process as a result of combining TSPi with the previous organizational process.

A basic training was provided for the new process, and historical data were collected in order to facilitate the estimation of the pilot project and the comparative study.

In the following section, the article shows the organization, the development context and the pilot project attributes. Later, the historical data collection will be described, and the new process will be showed and the advantages pointed out. The project goals will be verified using the project measures, and finally, the conclusions will be showed.

The schema showed in Figure 1 resumes the factors considered in the project.
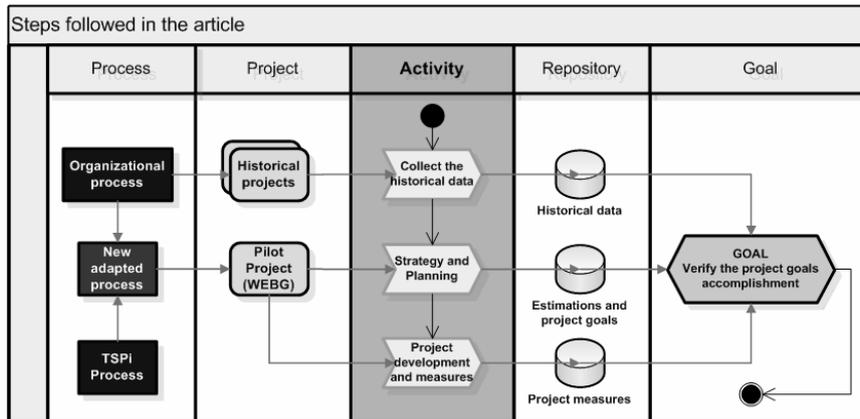
Figure 1 – Factors considered in the project

Context: The organization and the pilot project

UPTA is a Spanish intersectorial organization who takes care of all the scopes of economic activity which they are exerted by self – employment. UPTA leads a lot of projects which generally need a specific software development and in the last year, the number of software projects has increased.

The working scenario has changed to a new environment where many projects were developed simultaneously, and with a greater number of involved people. As a result of an internal assessment, senior management detected that projects were delayed, dedicating additional efforts to accomplish the objectives. Moreover, products quality had decreased.

UPTA was interested in introducing a process model such as CMMI, but it could not afford it.

Besides this handicap, UPTA had a project (called PRO) with schedule and budget constraints, and was delayed. The organization selected this project as the pilot. The purpose of "PRO" was to develop a tool that allows creation of a web site based on templates and a basic content system where the end users does not need technical knowledge.

According to TSPi criteria, during the strategy phase, the team agreed to reduce the initial functionality by 20%. The team established the following project goals (see Table 1):

Table 1 – Project goals

Measure	Goal
Schedule deviation	< 8% (1 week)
Effort deviation	< 15%
Budget deviation	< 15%
Test productivity	< 33.4 hours/KLOC (historical average)
Project productivity	> 7.3 LOC/hour (historical average)
% Release defects	< 5%

Collecting the historical data

Data on previous UPTA projects were not enough. There were only schedule and budget data, but in order to verify the project goals, defects and phases efforts data were needed.

Estimations values and measures related to schedule, size, effort and defects were collected. In addition, some derived metrics were calculated in order to analyze the project results.

Lines of code (LOC) were chosen because it could be done automatically. Based on the LOC and the effort of previous projects, the historical average productivity was calculated. This information was used to estimate the pilot project size.

In order to support the analysis, historical projects were divided into three phases:

- Development phase (process): From the launch until before the test.

- Test phase: It includes integration and system tests.
- Release phase: From the product release to the customer until the end of the third month of use.

Phase effort and defects data of these phases are approximate values because there was no previous data repository.

The selected historical projects were: HIS-1 (23 KLOC), HIS-2 (7 KLOC), HIS-3 (33 KLOC), HIS-4 (11 KLOC) and HIS-5 (104 KLOC).

The process

The process is a customized process as a result of blending the basic TSPi principles and the previous organizational process.

Once the new process was defined, the project started with training on the new process and the launching meeting.

The TSPi phases were used in the new process in order to get benefits from its procedures and metrics, but the intermediate products, such as requirements or design specifications, were based on the previous organizational process in order to reduce the change impact.

The focus on quality is the main difference with the previous organizational process. Examples of this approach are the quality plan relative to the phases and processes performance, inspections and reviews.

With respect to project management, weekly meetings and the earned value method were introduced. These gave to the project a real visibility and an effective tracking. The schedule, goals, risks, and change requests were evaluated in the weekly meetings.

The team was empowered to estimate and plan the project balancing the workload, and so, were more committed. Also, a good role definition was adopted.

Table 2 shows the basic TSPi principles applied in the process and the difference with the previous process.

Table 2 –TSPi principles applied in the new process

New process	Previous process
Process well defined. It makes easier the estimation and tracking project	Process with inconsistencies. The phases are not well defined
Team motivated, participative and collaborative	Only a project leader elaborates the project plan and the task distribution
Quality focus based in an early defect detection and reduction	Since the schedules are restricted, the quality was not considered
Introduction of inspection activities in the process	Only personal reviews without a quality control
Detailed plan in order to avoid schedule, and effort deviation	Projects begin with cost and schedules pre-established and restricted
Tracking and project visibility with the earned value method	There is no mechanism to track the project status
Weekly meeting to analyse the project and resolve process issues	There are no formal meetings and they are preformed only when there are problems

Verifying the project goals

In order to verify the project goals, measures were evaluated based on the initial plan (see Table 1).

5.1. Goal 1: To finish the project within the established schedule, cost and effort.

The results obtained in the project related to schedule, size and effort are (see Table 3):

Table 3 – Estimation vs. Actual

Measure	Estimation	Actual	Deviation
Schedule [SEM]	13.0	14.0	7.7%
Effort [HRA]	950.0	1121.0	18.0%
Size [KLOC]	6.9	8.5	22.5%

Table 4 shows that only there was one week of delay in the schedule. The effort can be considered acceptable because the actual value is close to the estimated value.

Table 4 – Goal 1 results

Measure	Goal	Actual	Deviation
Schedule deviation	< 8% (1 week)	7.7%	-3.8%
Effort deviation	< 15%	18.0%	20.2%
Cost deviation	< 15%	18.0%	20.2%

Cost data are derivated from effort and the results are similar.

As an example of the earned value tracking visibility, to deliver the product on time, the team decided to work with a little more intensity at seventh week because they observed a possible delay. Also, as can be seen in Figure 2, in last week (13) there was no earned value because the team was dedicated to fix a defect detected in the system test phase.

The weekly meetings and the earned value method allowed the improvement of the project management [Humphrey, 1995] (See Figure 2).
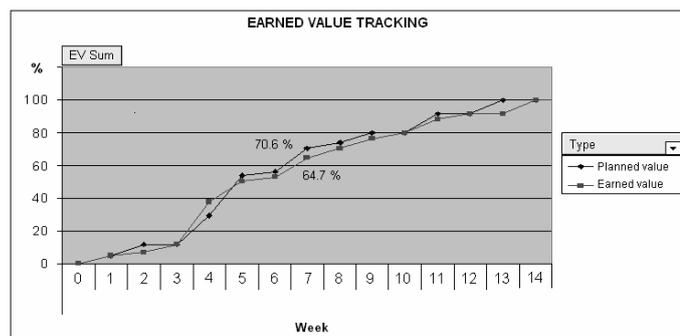
Figure 2 – Earned value tracking

5.2. Goal 2: To reduce the test time

Table 5 shows the reduction on the test time and test productivity. Note that the goal values were established using the average of the historical data

Table 5 – Goal 2 results

Measure	Goal	Actual	Deviation
Test time reduction	< 24.4 %	10.0 %	-59.1%
Test productivity [Hours/KLOC]	< 33.4	13.2	-60.5%

Figure 3 shows that the test productivity has improved 20.2 hours/KLOC, which means 60.5% better than the historical average.
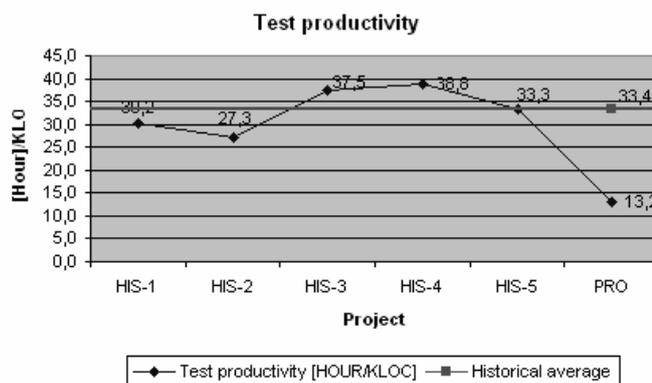
Figure 3 – Test productivity

Figure 4 shows the test time reduction. Only 10.0% of the project time was needed, which means 59.1% lower than the historical average.
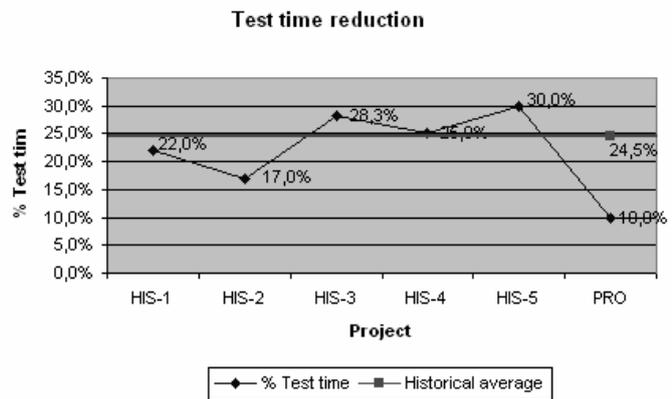
Figure 4 – Test time reduction

5.3. Goal 3: Increase the productivity and improve the product quality

Table 6 shows the project productivity and released defects goals. The project productivity had no important improvement.

Table 6 – Goal 3 results

Measure	Goal	Actual	Deviation
Project productivity [LOC/Hour]	> 7.3 %	7.6 %	3.9%
% Released defects	< 5.0	3.8	-24.8%

Figure 5 shows the project productivity improvement compared to the historical average.
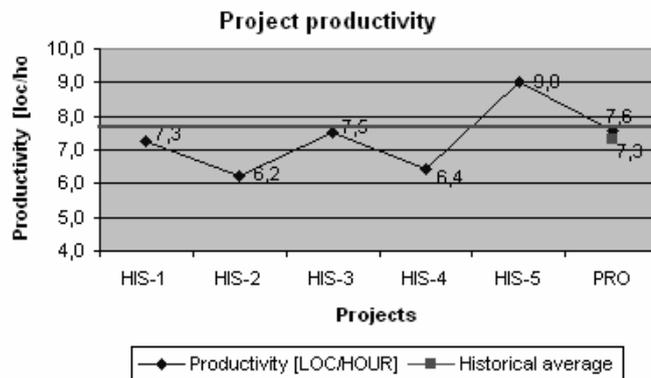
Figure 5 – Project productivity

One of the best results of this project was the reduction of the released defects. A released defect is a defect found during the first three months of operation. This was possible because the quality TSPi principles were applied, introducing reviews and inspections to get an early defect detection.

Figure 6 compares the released product defects using the new process with the historical average.
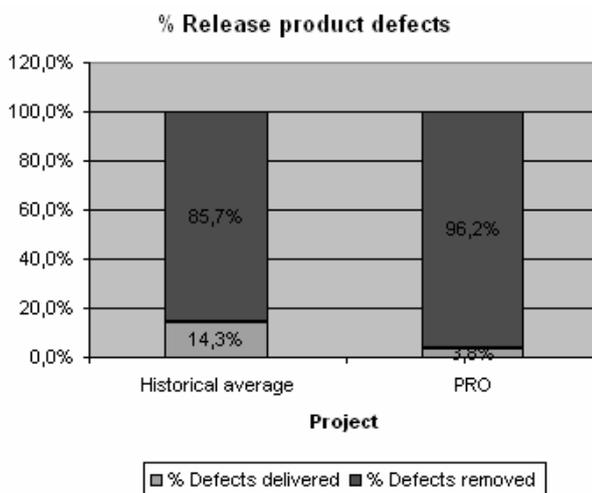
Figure 6 – Release product defects

Conclusion

The use of TSPi principles in the new process allowed the accomplishment of project goals based on the following considerations.

1. The team integration, the detailed plan, the change management, the weekly meetings and the earned value method allowed the accomplishment of these goals.
2. Along the project, the responsibility of the team members increased the test productivity by reducing the rework.
3. The reviews, inspections and quality plans allowed the reduction of test effort. The team members understood the test phase as a quality evaluation and not as a defect detection activity.

With an affordable investment in process definition, it has been demonstrated that using TSPi with adaptations has permitted a good solution for process improvement in Small Settings.

This article will be the foundation for future actions such as establishing the adapted process performance or comparing the adapted process quality versus the TSPi quality indicators.

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