APIS - A Web-based System for PSP/TSP

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Abstract. A useful supporting tool is very important to the success of PSP/TSP adoption. Based upon our experience, we summarize the requirements of a useful PSP/TSP supporting tool as follows: 1) support all phases of the PSP/TSP completely; 2) record and use historical data easily; 3) support teamwork effectively; and 4) provide team data in real time, enabling the PSP/TSP coach to see the process data at any time. In this paper, we propose a web-based PSP/TSP supporting tool, APIS (Advanced Process Improvement Solution). This tool meets all of the requirements stated above. APIS was deployed in SaaS (Software as a Service) manner, and users can rent software through the Internet. APIS has been used in more than thirty projects, and we have received a lot of positive feedback.

1 Introduction

Tools are playing an important role in PSP/TSP [1], [2], especially for process improvement. The successful application of tools in Mexico is a good example. In their report [3], there is a table which shows the quality comparison between CMU/SEI projects, Typical Projects and Mexican Phase I Projects. The quality of these projects has been improved.

In the last three years, the Software Institute of Nanjing University experimented with a new education approach to improve software development process. This initiative applies a well-defined and measurable process called the PSP/TSP [4, 5], which has been practiced by many top software development organizations. The objectives of our approach are listed below:

● Provide developers with process material which will help them to understand and learn a disciplined approach in the development of software easily;

● Engage developers in teams in which they can communicate and co-operate effectively;

● Provide PSP/TSP coach with process data to supervise a software development team.

To achieve these objectives, we listed a number of tasks in this approach. Among them, the major tasks are collecting, managing, and analyzing the process data. Another task is to support teamwork effectively. We need a process supporting tool to coordinate these tasks.

The remainder of this paper is organized as follows. Section 2 explains why we develop APIS. Section 3 describes how the APIS can support PSP/TSP. Section 4

provides an overview of possible future enhancements of APIS. Section 5 is the conclusion.

2 Goals for APIS

Since the PSP/TSP has been recognized by the software development industry as an effective way in teaching software engineers a disciplined engineering method [6], we have experimented with integrating TSP/PSP into our new education approach.

The results of a survey conducted at the end of each semester have shown that the process support tool, SEI PSP Workbook, has several weaknesses: 1) it can't save historical data; 2) it is a stand-alone version which can't support teamwork effectively; 3) coach can't see the real-time process data. Based on our 4 criteria (Table 1), we also evaluated three popular PSP/TSP supporting tools and the findings are provided below.

Table 1. Comparison between different PSP/TSP tools.

Tools→ Our Criteria ↓	Team Dashboard [7]	Point [8]	TSPi Workbook
Support all phases completely	Partially	Partially	Yes (cover all forms provided by SEI)
Record and use historical data easily	Yes (need expertise in PSP/TSP)	Nominal (convert an Excel file to web based tool using relational database)	Minimal (a programmed Excel file)
Support teamwork effectively	Yes	Minimal (support multi projects)	No
Provide team data in real time	Minimal	Yes	No

Although these tools have their own features, they can't fully meet our 4 requirements. Therefore, we proposed to develop our own PSP/TSP supporting tool.

3 A Practical Tool for Process Management

3.1 Support All Phases

Developers should make many plans (schedule plan, risk plan, quality plan and so on) in the TSP launch phase. APIS can guide developers to make each plan mentioned above. For example, when a team wants to make a schedule plan, all that developers need input are each developer's weekly working time and each task's total hours which can be estimated by using PROBE method. According to the hierarchy in project's tasks, Developers can customize a schedule plan using APIS (Figure 1).

Task	Begin time(p)	Begin time(A)	End time(P)	End time(A)	Assign to	Phase	Status
☐ 📁 practice project	10/25/10		11/18/10		栗国平		NEW
☐ 📁 Cycle One	10/25/10		11/18/10		栗国平		NEW
☐ 📁 REQ	10/25/10		11/05/10		dev1		PLANING
☐ 📁 IMP	11/05/10		11/18/10		dev3		NEW
☐ 📁 Controller	11/05/10		11/18/10		栗国平		PLANING
☐ 📁 Register Action	11/05/10		11/11/10		dev3		PLANING
Detailed Design	11/05/10		11/08/10		dev3	Detailed Design	PLANING
Detailed Design Review	11/08/10		11/08/10		dev3	Detailed Design Review	PLANING
Code	11/08/10		11/09/10		dev3	Code	PLANING
Code Review	11/09/10		11/10/10		dev3	Code Review	PLANING
Compile	11/10/10		11/10/10		dev3	Compile	PLANING
Unit Test	11/10/10		11/11/10		dev3	Unit Test	PLANING
☐ 📁 Login Action	11/11/10		11/18/10		栗国平		PLANING
📁 TEST					dev2		NEW
📁 Cycle Two					栗国平		NEW

Fig. 1. A Schedule Plan.

In a TSP team, everyone plays a different role and has his own responsibility. Take plan manager as an example, he should develop complete team plans and individual plans. At the end of each week, he will report the progress of the project. In general, there are six roles in a TSP team [1, 2]: Project Manager, Plan Manager, Development Manager, Quality Manager, Process Manager and Support Manager. AS a TSP supporting tool, APIS has authority management and make every member focus on his own responsibility.

In order to ensure the quality of software and improve the development process in the next project, APIS also integrate almost all of the templates, scripts and quality indicators in PSP. It is especially useful for new users, because they can just follow these scripts to record data in templates and needn't worry about missing any data.

At last, APIS has three different ways to track a project during the development time. They are Weekly Report [2], PV&EV [2] and Milestone. Milestone uses goal-driven method based on a hypothesis that: if all the goals are finished [9], the project is completed.

3.2 Data Reuse

How to use historical process data is a general problem. APIS tried to improve the accuracy of making plan at the beginning of a project. APIS records previous projects' risks and strategies as a repository. When developers meet a same problem in a new project, they can refer to this repository and find corresponding answers easily. APIS also has statistical module, and based on more history data, we can make a more accurate estimate for new projects. We expect to utilize previous projects' experience to offer a better service for the next project.

3.3 Support Teamwork Effectively

The goal of the development of APIS is to provide a shared tool for PSP/TSP data repository and analysis used by both the academic and industrial communities. Now, World-Wide Web (WWW) has been the most popular Internet access mechanism used by people around the world. Web-browser is all that is required to access the Web server. Therefore, the users' burden with incompatible software can be reduced.

APIS uses a relational database to manage multi projects and team data centrally. Figure 2 shows the directory hierarchy of our TSP database server. It was divided into 4 subdirectories (Projects, Resource, Repository, and Logs). In the Projects Directory, there are the each project's process data and staffs' information; Resource Directory records many templates and scripts to guide new users; Repository Directory records projects' strategies and risks; And the last Logs Directory records system log. Through the Internet, users can receive timely information about each team. The TSP database server was implemented by SaaS multi-tenant model. To secure the process data, we choose the strategy of independent database. In other words, one tenant corresponds to one database. It simplifies the extension of the design of data model and can meet different tenants' unique demands.
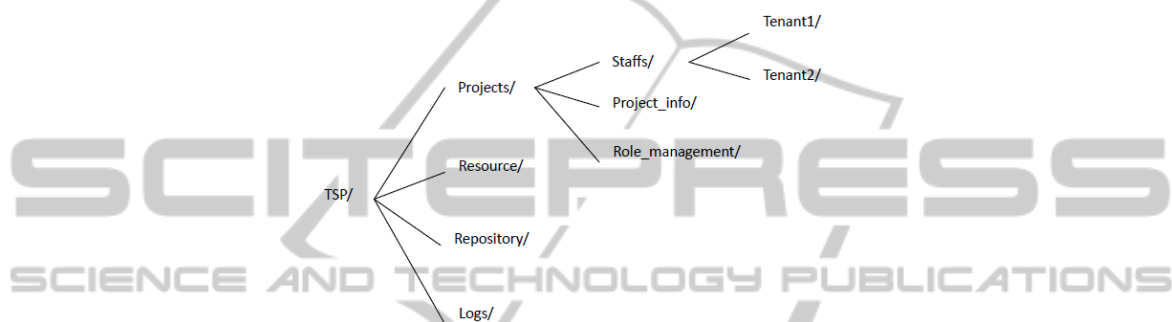

Fig. 2. Directory Hierarchy of TSP Database Server.

3.4 Timeliness

A Web-based tool provides developers real-time team data. Once a developer submits his process data, another team member can see the update on his own computer. In APIS's authority management, there is a role called "coach". Coach has a super permission which can refer to all the process data (Figure 3) about a development team, and supervise his team. The red curve stands for the cumulative PV (Plan Value), while the blue one stands for the cumulative EV (Earn Value). If the blue line is above the red one, it indicates that the project schedule is ahead. Inversely, if the blue line is under the red line, we should implement several measures to catch up the schedule.
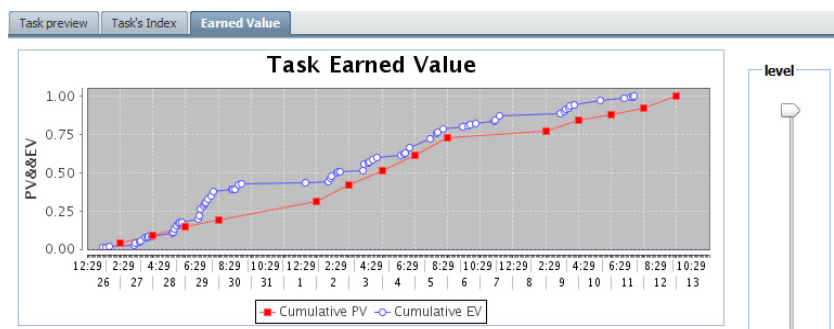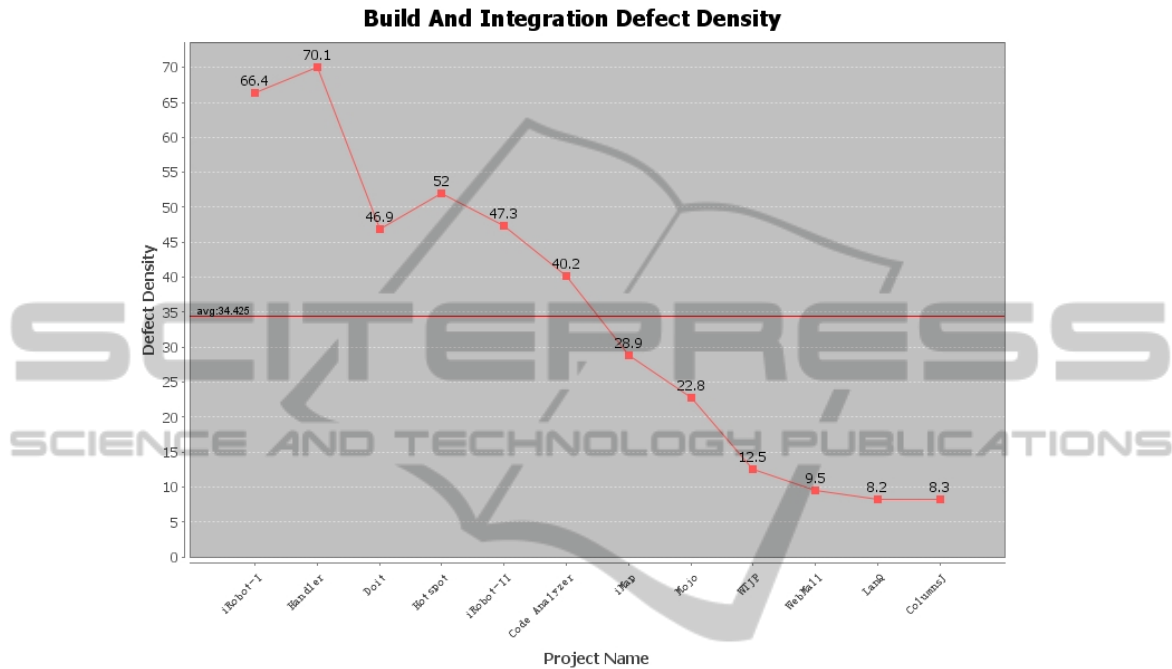

Fig. 3. PV&EV of a Task.

4 Discussion

Figure 4 shows the quality improvement of 11 teaching projects counted by APIS, from which we can find that APIS has actually improved the quality of software development.

Fig. 4. Build and Integration Defect Density.

4.1 A Survey

For some commercial reasons, we did a survey between students and teachers among whom some of them were familiar with PSP/TSP and the others were not before using this tool. There are about 100 people from more than 20 different projects who have participated in this survey. According to previous users' feedback, we enumerate some of the most popular topics:

a) Need expertise in PSP&TSP before using APIS
b) Under pressure by using the allocation of responsibilities
c) Not used to record data when I was developing
d) Can't adapt to the style of APIS's interface

Participants only need to select the topics they concerned according to their experience of using APIS. Figure 5 shows a statistical result. Topic A is the most common problem followed by C, D, and B.

According to the feedback from students and teachers, some deficiencies of the tool were also pointed out. Therefore, in the future, we will make some enhancements

to APIS. For topic B, it is a promoted efficient way to organize a team in TSP, so we will not have any changes on it temporarily. However, for the other three topics, there are now three ongoing TSP related activities conducted by our maintenance team. They are briefly described as follow:

● Manually input or automatically record process data. Up to now, developers should manually input individual process data. If we set a clock cycle or triggers to achieve process data automatically, developer would be under the pressure of the passage of time. To collect real time data, they even can't take a break while developing software. If there is a switch to close the clock, there are no differences between these two ways. We should investigate more process supporting tools and discuss whether it is a good advice.

● Continue to reduce the burden of studying PSP/TSP. According to Nielsen's usability heuristics [10], we will try to reduce users' burden of memory and provide more help information. Any such information should be easy to search, be focused on the user's task, list concrete steps to be carried out, and not be too large.

● With more and more projects are using APIS, we should extend the web server's response ability. At the same time, database server will record much more data.

In the future, we want to add functions about process simulation and modeling [11]. APIS have collected more than 30 projects. In others words, we now have collected many process data. How to fully utilize these resources to help the next project is a good question. Up to now, APIS has not integrated any mathematical models to help process simulation and modeling. Therefore, it will be a good trial.
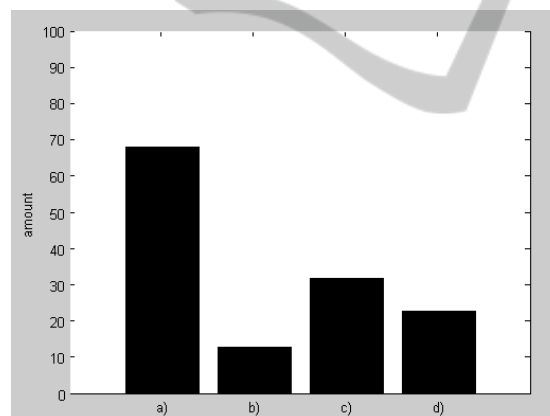
Fig. 5. The Statistics Result.

5 Conclusions

Based on the experience in teaching TSP/PSP and using supporting tools, we summarized 4 important requirements for a useful TSP/PSP supporting tool. After an investigation into the available supporting tools, however, we find out that those tools can't fully meet our 4 requirements. Therefore, we develop our own supporting tool—APIS, which is a web-based tool and can fully meet our 4 requirements.

Until now, APIS has been used in more than 30 projects, among which some projects are from the industry and others are from academia. We have received a lot of positive feedback as well as useful suggestions. In the future, we will make some enhancements to the tool, so as to better support TSP/PSP.

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