

A STUDY ON SOFTWARE PROJECT COACHING MODEL USING TSP IN SAMSUNG

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Abstract: Reasonable planning for the project, monitoring of the project status, and controlling of the project with appropriate corrective actions are key factors for successful software project management. If the project leader gets helps and supports from an expert who have the know-how of software project management instead of depending on only their own discretion, these activities can be conducted much more effectively. The TSPSM(Team Software ProcessSM) is a process framework developed to provide guidelines on software development and management activities for teams. Samsung Electronics introduced the PSP/TSP technology to meet visualization and high efficiency needs in software development, in 2003. In this paper, we propose the software project coaching model based on the TSP/PSP experiences to support the project leader and the team members efficiently and analyze the applying results and effects.

1 INTRODUCTION

Through experience as a software process and quality engineer for many years, we've learned that the key factors that make software projects successful are effective project tracking and controlling with reasonable project planning. These in turn are governed by a right judgment of a project leader on the project status and follow-up measures. Currently, most project leaders in our organization manage their projects in the way that they make a project plan according to organizational standard process and assign works to team members. And then they review what have done, what to do next week, and issues raised at the weekly team meeting. However, there exist limits in that project planning and updating are dependent on only the project leader and so the level of project control is likely to vary according to skill level and experiences of the project leader. Therefore, it is needed to develop the practical guideline for software project management so that consistent and effective project management can be applied, considering the development environment of our organization.

The TSPSM(Team Software ProcessSM) (Humphrey, W., 2005) is a process framework developed for the purpose of providing the guidelines on software development and

management activities for teams, while the SEI-authorized TSP launch coach helps a project leader and team members to apply the TSP. Within Samsung Electronics, the PSPSM(Personal Software ProcessSM) (Humphrey, W., 1995) training course that was a prerequisite for using TSP have been offered to 375 developers since 2003 and a few TSP projects have been tried. In this paper, we propose the software project coaching model based on PSP/TSP experiences for years. This coaching model is shooting for customized coaching for the software development team on the TSP basic framework.

This paper is organized as follows. In Section 2, we look into the TSP basic concepts and TSP experiences in other organization. We explain the software project coaching model in Section 3 and analyze the effects by comparing results before and after applying the coaching model in Section 4. Finally, we conclude and describe future works in Section 5.

2 RELATED STUDIES: TSP AND TSP EXPERIENCES IN OTHER ORGANIZATIONS

The TSP Framework contains Team Building Process which is represented by the TSP launch workshop and Team Working Process that addresses engineering processes and practices used by the team. All activities on the TSP framework are conducted under technical support of TSP coach.

The TSP can be a process instance for team which offers how to do each engineering or management activity concretely, while the process areas in project management category of CMMI(Capability Maturity Model Integrated) (SEI, 2006) and PMBOK(Project Management Body Of Knowledge) (PMI, 2004) focus on what activities should be conducted for project management. Therefore, in many organizations that adopted the TSP, we can find easily a feature to apply the TSP in conjunction with CMMI in order to improve their process. The P-3C organization of NAVAIR(the Naval Air Systems Command) is a good example that has accomplished software process improvement from level 1 to level 4 in just 27 months through using the TSP in conjunction with the CMMI framework (Wall D. S., McHale J., Pomerroy-huff M., 2005). Other case is using the TSP linking with Six Sigma (Dan S., Duine V., 2006). The TSP philosophy is consistent with Six Sigma's in that it takes a quantitative approach regarding software development, so there can be synergy if two methodologies are integrated properly. Many other valid approaches to adopt the TSP can exist and, in this study, we focus on a customized coaching, considering characteristics of development team and organization.

3 SOFTWARE PROJECT COACHING MODEL USING TSP

When new methodology or technique is introduced in some organization, in order to convey its intended messages properly, it is helpful to keep the person who supports and monitors it. The TSP coach has a role to help a team leader and team members to use the TSP framework as well as acts as a change agent for successful introducing of the TSP/PSP technology within the organization. In the initial stage, our aim was to delivery the TSP basic

concepts accurately and to verify the value and the usefulness. However, there existed a limit in increase of effectiveness for the issues such as redundancy of existing process and tools and a burden of additional data gathering. In our view, this was due to that we didn't consider enough the organizational development environment and the characteristics of the development team, and finding a solution for these problems becomes the goal of this study.

The primary focus of the coaching model proposed in this paper is on two purposes: customizing TSP process in order that it is merged with the organizational development environment and customizing TSP coach's role to support the team in different ways according to the team's characteristics. Figure 1 illustrates our approach.

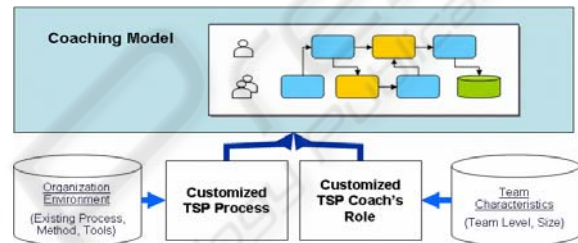


Figure 1: Approach for developing coaching model.

Figure 2 is the detailed coaching process of our model. The thin solid line and the dotted line represent the coach's roles and the development team's roles respectively, and the thick solid line means the cooperative activities of the coach and the team. The activities at the top of figure are conducted under the leadership of the coach, whereas the activities enumerated in the bottom part are works of which subject is the team. We also marked improved area and added area in our coaching model with symbols shown in a legend of Figure 2.

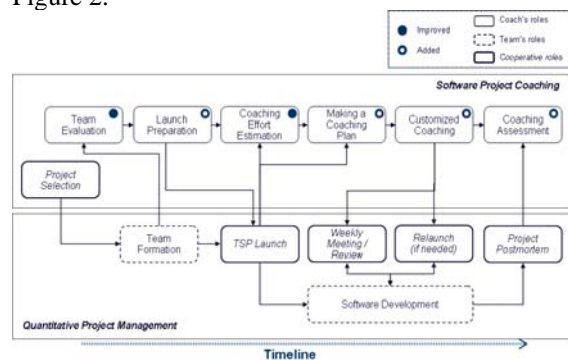


Figure 2: Detailed coaching process.

3.1 Project Selection

This step is for selecting projects to apply the coaching model. Basically, the projects that can meet requirements needed to use the TSP should be selected, for our coaching model is based on the TSP framework. The TSP was devised for supporting the team with 3~15 members and the prerequisites are as follows;

[The prerequisites for using the TSP]

- Not only should the senior manager understand enough the TSP central concepts and respect the plan made by the team, but he or she should not use the team's data for any other purpose such as evaluating individuals.
- There should be an agreement regarding data collection and submission from the team members.
- All team members have taken a PSP for engineer course.

However, in this study, we couldn't find the team in which all team members had taken a PSP for engineer course. Hence, we decided to offer the PSP course to the team members who didn't get the PSP training just before the TSP launch, after selecting projects only by the first and second requirements.

3.2 Team Evaluation

The roles and efforts of the coach vary with the maturity level of the development team. Therefore, we defined the four maturity levels as described below and tried to conduct a customized consulting and supporting according to the team's level.

[Team Maturity Level]

- Unlearned: The team that doesn't learn about the basic concepts and techniques of software measurement and quantitative project management.
- Learned: The team that has learned about basic concepts and techniques, but inexperienced in the TSP.
- Skilled: The team that has knowledge and experience of the TSP, and so gets skill in estimation and analysis for quantitative project management.
- Self-directed: The team that is managed itself. The team is skilled in teamwork, works aggressively to meet its goals and deals with issues came up effectively. The TSP achieves high performance by building self-directed teams.

Table 1: Criteria for evaluation team level.

PSP Trained TSP Experience	Rarely (~50%)	Partially (50%~)	Fully (100%)
0 year	Unlearned	Unlearned	Learned
1 year	Unlearned	Learned	Skilled
2 year	Learned	Skilled	Self-directed

The maturity level of the team depends on TSP experience and the number of PSP trained members and the criteria for evaluating team's level are as shown in Table 1.

3.3 Launch Preparation

The one of primary jobs of the coach that is conducted in this step is integrating existing process or tools used in project planning with the TSP launch process. For example, if there is a checklist for risk assessment, the coach prepares in advance to use it at the TSP launch meeting 7 which is for conducting risk assessment. It is very helpful to make and use a mapping table, and the coach can check special items that are different from those of other teams after including general items in the mapping table in advance. In addition, the coach prepares to explain how to do the TSP launch or what are the responsibilities of the TSP role for managers in accordance with the status of the team.

3.4 Coaching Effort Estimation

It is important to estimate efforts needed for coaching to make a reasonable coaching plan, for the coach involves other works except coaching within our organization. In this step, an overall coaching effort is estimated based on three kinds of information: team's maturity level from step 3.2, the number of team members, and the overall project schedule estimated at the TSP launch. Table 2 illustrates a coefficient for calculating coaching efforts. For example, if the unlearned team with eight members estimates the overall project schedule at six months, we estimate that it will take three months for the coach to support that team. But this estimate can be adjusted according to coach's experience with 27% VAF(Value Adjustment Factor). This VAF was derived from analyzing individual coaching time in the PSP training, for we decided the VAF would be equivalent between individual coaching and team coaching. For four years, we've provided PSP training to 375 developers and found that there was a deviation of about 27% on the instructor's effort needed.

Table 2: Reference table for estimating coaching effort.

Team Level \ Team Size(persons)	Small (3~5)	Medium (6~8)	Large (8~15)
Unlearned	1/3	1/2	1/2
Learned	1/4	1/3	1/2
Skilled	1/5	1/4	1/3
Self-directed	1/5	1/5	1/4

3.5 Making a Coaching Plan

We divided activities of the coach into four types; developer training, supporting the TSP launch/relaunch, weekly monitoring and consulting, and interim or final performance analysis. Because developer training among these is finished before project starting, the coaching plan focuses on three other activities. The key difference from original TSP framework is to have a different coaching plan according to team's maturity level. For example, in case of the self-directed team, the coach makes a plan to guide the team based on team's requests, contrary to the unlearned team that a conscientious coaching plan is needed. The way of coaching also differs from team to team in that the on-site coaching period for the unlearned team is much longer than that of the skilled team or the self-directed team.

3.6 Customized Coaching

In this step, customized coaching is conducted according to the coaching plan made in step 3.5. Once the team members are familiar with the TSP process and gather reliable data in two to four weeks, the main job of the coach moves into helping the team leader to cope with various problems from the project in a timely manner. Inevitably, a project is likely to show deviations from planned in its actual progress. A significant schedule deviation may mean that the project may be heading for failure and this situation demands that the project leader understand the reasons for the variation and take corrective actions. For the purpose of supporting the project leader more effectively, we developed the guideline checklist for causal analysis and control actions by the project status. After getting at current status of the project by actual versus estimated analysis of schedule, effort, and defect, the project leader finds the reference number using the project status indicator table. And then he or she checks reasons and actions to consider in the guideline checklist and applies corrective actions, if necessary. However, if the estimates were too aggressive, the project leader might revise the estimates. This mechanism is illustrated in Figure 3.

3.7 Coaching Assessment

This is the step for assessment and improvement of coaching model. After completion of the project, we

provided evaluation forms to the team members to get information regarding team satisfaction and ask for feedback. The questionnaire contains five categories as drivers of team member satisfaction as described below.

[The Team Satisfaction Survey]

- Fidelity: The questions to ask how faithful the member prepares and works in conformity with the process provided.
- Method/Process: The questions to ask whether the method and process provided are practical and helpful.
- Materials/Tools: The questions to ask whether the materials and tools provided are practical and helpful.
- Benefits: The questions to ask about real benefits that the member feels due to applying new method.
- Other Improvement Proposals: The questions to ask about improvement proposals for new method and the coach.

We made three or four questions per each category and scored one to five points per question. When we conducted this team satisfaction survey to the team members in the base projects of this study, we got high scores and positive comments (see Figure 4).

4 RESULTS AND EFFECTS

In this section, we analyze the results of the coaching model proposed. Our analysis points of view are the benefits of the coaching model and the team satisfaction. Customized coaching by the team characteristic, such as team size and maturity level, is the first and most important benefit. Without the formalized coaching model, it is difficult to apply customized coaching, for there are not objective criteria and strategy for this. Second, the mapping table was developed so that the TSP process could be linked with existing organizational process and tool systematically, in turn avoiding redundant work due to applying the TSP. Third and fourth, it is possible to provide consistent coaching through standardization of coach's role and easy to improve a coaching skill through sharing and transfer of coaching know-how or experiences. Fifth, readiness for spread of the TSP framework throughout our organization and sixth, flexibility in introducing new technology such as cost estimation techniques are primary benefits that are feasible only when using the coaching model proposed. And all these benefits were obtained without an injury to the TSP basic concepts and effects.



Figure 3: Reason and follow-up actions by project status.

Table 3: Performance results before and after coaching model.

Key Performance	Without TSP	With TSP			TSP Results by SEI (Range)
		Before using Coaching Model (for initial plan)	After using Coaching Model (for initial plan)	Deviation	
Schedule Deviation (%)	-	3.5 (25)	0.65 (19.15)	5.4 : 1 (1.3 : 1)	6 (-20~+27)
Effort Deviation (%)	-	20.97	15.25	1.4 : 1	26(5~65)
System Test Defect (Def/KLOC)	4.09	1.86	0.88	2.1 : 1	0.4(0~0.9)
System Test Duration (Days/KLOC)	3.04	2.67	1.81	1.5 : 1	0.5(0.2~0.8)
System Test Effort (% of total)	33.8	19.6	6.1	3.2 : 1	4(2~7)
# of projects	1	2	4	-	-
Average Size (LOC)	16,866	53,797.5	51,443.3	-	-

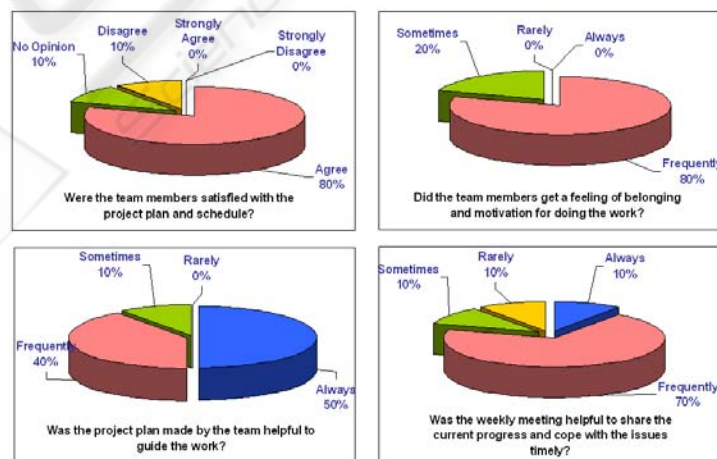


Figure 4: Team satisfaction evaluation.

Table 3 shows the results of project performance analysis before and after applying our coaching model. To compare more objectively, we mentioned both results in company with the TSP results reported by SEI. As shown in Table 3, we've got better results than that of non-TSP projects, but also the results as good as SEI reported, irrespective of applying our coaching model. However, we can find the fact that the performance after using our coaching model is much better than that before using the coaching model. In other words, our coaching model is beneficial to project performance, too. The impact of increasing productivity of the teams or Hawthorne effect on this performance improvement can be negligible because we don't focus on increasing in productivity of team in our methodology. But, the fact that we can't statistical analysis, such as significant level because base projects are very few is a limit of our paper.

Figure 4 shows the results of the team satisfaction survey. The questionnaire mentioned in section 3.7 was used and especially, the answers of the detailed questions in benefit area were analyzed. For all four items, namely a reasonable project plan and schedule, a feeling of belonging and motivation, practical and helpful guidance, and timely measure, more than 80% of the team members answered positively. That means the team feels a high level of satisfaction.

5 CONCLUSIONS

In the PSP/TSP introducing strategy of SEI, the roles of agents who lead a change are strongly emphasized. Therefore, the change agent, such as PSP/TSP instructor and TSP coach, is core part, not just role in the PSP/TSP process. After introducing the TSP technology for quantitative and effective software project management, we felt need for developing the coaching model which was designed and formalized for considering our development environments and various characteristics of the development teams. Thus, the goal of our coaching model was offering customized coaching and we started with improving TSP coach's role. We strove to minimize overload and a redundant work due to applying the TSP through integrating organizational process with the TSP process and provide the optimized and consistent coaching to the team.

Our coaching model has three important elements; the method for team evaluation, the reference table for estimating coaching effort, and the guideline checklist which would be used for

conducting causal analysis and finding corrective actions by project status. In addition to provide the customized coaching, this research makes several contributions. The first is the fact that it is easy to share and transfer know-how for strengthening of coaching skill. Second, estimating coaching effort helps the allotment and control of coach's workload so that can accelerate improvement of coaching capability. Another contribution lies in that the coaching model is structured to be flexible enough to add the new technology, process or tools for software development. Lastly, this study has additional contribution in that the coaching model also has a beneficial effect on improving of project performance.

In order to estimate accurate coaching effort, more project data and coaching experiences should be accumulated, for this study is based on the data collected in only several projects in limited domains. Also, through integration other methods used in project management such as software estimation techniques and software reliability model, the more improved our coaching model is, the more effective coaching we offer, leading to successful software project management.

REFERENCES

- PMI, 2004. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Third Edition*, Project Management Institute, Newtown Square, PA.
- SEI, (2006). *CMMI Model Version 1.2*, Retrieved March 2, 2007, from Carnegie Mellon University, Software Engineering Institute Web site: <http://www.sei.cmu.edu/cmmi/models/models.html>
- Humphrey, W., 1995. *A Discipline for Software Engineering*, Addison Wesley, Reading, MA.
- Humphrey, W., 2005. *TSP: Leading a Development Team*, Addison Wesley, Boston, MA.
- Dan S., Duine V. (2006). *Experiences Integrating PSP and TSP with Six Sigma*, Retrieved March 2, 2007, from Carnegie Mellon University, Software Engineering Institute Web site: <http://www.sei.cmu.edu/tsp/sym2006-presentations/integratesix.pdf>
- Wall D. S., McHale J., Pomeroy-Huff M. (2005). *Case Study: Accelerating Process Improvement by Integrating the TSP and CMMI*, Retrieved March 2, 2007, from Carnegie Mellon University, Software Engineering Institute Web site: <http://www.sei.cmu.edu/publications/documents/05.reports/05sr012.html>