



Software Engineering Institute

TSP Performance and Capability Evaluation (PACE): Team Preparedness Guide

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Abstract

A Team Software Process (TSP) Performance and Capability Evaluation (PACE) provides an objective way to determine the capability of software development organizations and programs. This document describes the TSP team data that teams normally produce and that are required as input to the TSP-PACE process. This document includes standards and specifications associated with the data required and describes how the data is used to evaluate a team's work.

1 Introduction

This document describes the Team Software Process (TSP) team data needed as input to the TSP Performance and Capability Evaluation (PACE) process and describes how the data is used to evaluate a team's work. It also includes standards and specifications associated with the data required for a TSP-PACE. If teams do not collect the data required for the evaluation as they work on a project, it will be difficult, if not impossible, to recover the data at a later time.

TSP teams must do three things to be properly prepared for a TSP-PACE:

1. Follow the TSP process as they do their work .
2. Properly gather the data called for by the TSP process.
3. Provide responsive and high-quality products and services to their customers.

A TSP-PACE provides an objective way to determine the capability of software development organizations and programs. Certification is useful for acquisition organizations seeking to acquire software and services from a supplier because it provides an independent and factually-demonstrated evaluation of the organization's or program's capability. This assures software acquirers that the evaluated organization's performance data as presented in the TSP-PACE evaluation profile is valid. If one assumes that the organization will continue to perform at this same level, the certification can be used as a predictor of future performance.

The TSP-PACE process is used to evaluate programs or organizations. A program can consist of a single project or multiple projects. Evaluations can be used by management or by acquisition authorities to assure themselves that key programs or parts of an organization are using sound methods, have demonstrated success, and can be expected to produce timely and high-quality work. Evaluations can also be used by leading software development and service organizations to distinguish themselves from their less capable competitors.

A TSP-PACE is based on an independent evaluation of an organization's or program's performance in doing software engineering work. The evaluation includes the predictability of project costs and schedules and the quality of the delivered products.

A TSP-PACE assesses the degree to which the program or organization

- has implemented and used the TSP process
- can produce work products that are measured in terms of cost, schedule, quality, and overall customer satisfaction

The TSP-PACE process is based on multiple analyses of project data within a program or organization. A TSP-PACE *program* evaluation only applies to the program that was evaluated. A TSP-PACE *organizational* evaluation applies to that segment of the organization that is within the evaluation scope. It is valid only for a specified period and must be renewed periodically.

2 TSP-PACE Description

The principal requirement for a TSP-PACE is that the applicant collects and provides all of the data needed to produce the evaluation profile. The evaluation does not judge applicants' performance, but rather the demonstrated capability to measure and articulate their performance using the TSP. In addition to the data normally submitted by the TSP coach, the team data required for a TSP-PACE is specified in the Launch Data Standard, the Post Mortem Data Standard, the Project Performance Summary Specification, and the Post Mortem Report Specification, which are in the appendices of this document.

The evaluation also examines changes made during a project lifecycle (for example, changes to goals, features, staffing, etc.). These changes are reported by the applicant in the TSP Project Change Record, which is also included in this document. This record summarizes changes that are often recorded by the TSP team in meeting minutes or through other mechanisms. This type of information is essential to understanding project performance and is typically unavailable in the team's TSP tool. The evaluation further asks that project data be summarized in two sets of data forms, the *Product.Process* and the *Project.Cycle.Summary* Microsoft Excel workbooks. The forms are designed to support postmortem analyses that typically require team member knowledge of the project. It is recommended that the teams either use these forms or summarize the equivalent information during each cycle and project postmortem. The forms support the analyses of goals, specific components, and customer processes.

After the organization or program has submitted the TSP data for evaluation, the SEI will assign a trained evaluator to arrange an on-site evaluation to verify the accuracy and completeness of the applicant's data. Using the on-site evaluation report, the SEI will do the following:

Assesses the TSP-PACE scope: Is the TSP-PACE scope defined clearly? Is the required data available for all of the teams within the evaluation scope? Is data available on a sufficient number of TSP teams within the evaluation scope to warrant completing an evaluation?

Assesses the quality of the TSP data: Did all of the TSP teams within scope gather accurate and complete data on their work to support a TSP-PACE decision?

Assesses the use of TSP training: Were authorized instructors used and were the executives, managers, team leaders, and team members trained in the TSP and PSP?

Assesses the use of TSP coaching: Were SEI-certified TSP coaches used? Did the assigned coach support the team's launch preparation, launches, and daily operation? Did the assigned coach guide the team and team leader in following the TSP process and in conducting and reporting the launch results, cycle postmortems, and project postmortems? For all of the TSP teams, was a coach available to consult with the teams? Did the coaches periodically, and on a per-requested basis, meet with every team and team member?

Assesses the quality of the TSP launches and relaunches: For each of the teams, did all team members and team leaders participate in the entire launch? Did executives or senior managers participate in launch meetings 1 and 9 and were they prepared for these meetings? Did management establish specific team goals and negotiate and approve a team-developed plan? Was a launch postmortem report produced and is it available?

Assesses the quality of the TSP cycle postmortem reports: For every project cycle of every TSP project team, was a complete postmortem report produced and is it available?

Assesses the quality of the TSP project postmortem reports: For every completed project for every TSP team within the scope of the evaluation, was a complete postmortem report produced and is it available?

Assesses the customer satisfaction data: Has the applicant gathered sufficient satisfaction data from its customers and are these customers satisfied with the work the applicant has performed?

3 Data Quality

TSP team members should record their time and defect data as they work, but they will occasionally forget or be unable to do so, and must later estimate and record the data. Occasional instances of estimated data are considered normal. However, in cases where the TSP process was not followed and the required data were “adjusted” to look as if the process was followed, the evaluation will be discontinued. Excessive data estimation will likely be viewed as unreliable and result in a discontinuation of the evaluation.

Therefore, TSP team members should record as much of their data in real time as they can. This will not only produce more accurate and useful data, but also result in higher process fidelity and better team performance. Experience shows that, when team members consistently estimate and record their data after the fact, they become less disciplined in following the TSP process. Then they are not likely to obtain the benefits that the TSP process is designed to produce. That is why high-fidelity team member data is one of the key requirements for a TSP-PACE.

To verify that all of the required TSP data were properly gathered, a TSP-PACE will examine the degree to which the team gathered all the data required by the provided standards and specifications. In addition, the evaluation will examine the team-member data to determine if the time, size, and defect data are complete and if they were gathered while the work was being done.

In addition to the core TSP data, final testing and user-reported defect data must be made available. A TSP-PACE certification cannot be granted without this data.

4 Determining if the TSP Process Was Followed

The evaluator will seek to verify proper use of the TSP process. This will supplement the data-based analysis performed by the SEI. The following section briefly describes what the evaluator and SEI will examine.

To verify that the TSP process was followed, a TSP-PACE examines the following four areas.

- process fidelity
- launch fidelity
- coaching fidelity
- leadership fidelity

4.1 Process Fidelity

To assess process fidelity, the evaluation examines the following:

- Did the team plan for and use defined process phases?
- Were appraisal phases planned?
- Did the team perform the appraisal phases?
- Did the team consistently record its actual time on task to the appropriate process phase?
- Did the team consistently record the defects found and where they were injected, or removed?
Did the team record the time required to find and fix the defects?
- Did the team record plan and actual size data?
- Did the processes and associated tasks reflect the work being performed?

4.2 Launch Fidelity

To assess launch and relaunch fidelity, the evaluator examines the following:

- In general, did the team leader and team members attend the entire launch?
- Did management attend launch meetings 1 and 9? Did the attending manager have decision-making authority?
- Did the team negotiate and agree with management on a plan that all team members committed to?
- Was the launch or relaunch facilitated by an SEI-certified TSP coach?

4.3 Coaching Fidelity

To assess coaching fidelity, the evaluator examines the following:

- Was a coach assigned to support the team?
- Is the coach certified by the SEI?
- Was a coaching plan produced?
- Did the coach and team follow the coaching plan?

4.4 Leadership Fidelity

To assess leadership fidelity, the evaluator examines the following:

- Was the team leader trained to perform her/his role by an SEI-authorized instructor?
- Did the team leader conduct regular TSP team meetings and report project status to management?
- Were the executives in the management chain trained to perform their roles by an SEI-authorized instructor or SEI-certified coach?
- What actions have executive management taken to assure TSP implementation fidelity?
- Did executive management conduct project status reviews to assess both process fidelity and project status?
- Did executive management respond appropriately to the data provided?

4.5 Quality Products and Services

To verify that the team provided responsive and high-quality services and products to its customer, the evaluator will examine the responses to the TSP Customer Satisfaction Surveys or an equivalent type of survey. To obtain these data, customers are asked to complete the survey and return it for evaluation. A copy of the TSP Customer Satisfaction survey and its instructions can be found in the TSP-PACE Application Guide.

4.6 After the On-Site Evaluation

If, after the on-site evaluation, the data are found to be accurate, reliable, and complete, the next phase of the evaluation will proceed. The SEI will then review the data and generate the organization or program evaluation profiles.

5 Summary

To be prepared for a TSP-PACE, TSP teams must do three things:

1. Follow the TSP process as they do their work.
2. Properly gather the data called for by the TSP process.
3. Provide responsive and high-quality products and services to their customers.

To determine if the TSP teams have done these things, a qualified TSP-PACE evaluator will conduct an on-site evaluation at the applicants' location and conduct interviews. If the interview data confirms the previously submitted TSP data, then a certification will likely be granted.

To ensure that teams are prepared for a TSP-PACE they must generate the required data as they do their work. If they do not, they generally will be unable to reconstruct the needed data.

Appendix A: TSP Launch Data Standard – Standard LAU-Data

Purpose	<p>This Launch Data Standard guides teams in</p> <ul style="list-style-type: none"> • recording complete launch data in a retrievable way • retaining launch data in a format suitable for later use <p>The launch data can be used by the team to</p> <ul style="list-style-type: none"> • compare team performance with the goals set during the launch • improve estimating accuracy • provide data needed for a TSP-PACE • provide data needed for other types of appraisal or assessments
General	<ul style="list-style-type: none"> • Launch data are required for every TSP team launch and relaunch. • The recorder enters the data specified for each launch meeting. • Where possible, these data are entered into the TSP support tool. • Where such data entry is not supported by the tool the team is using, the data must be recorded in a format that can later be used by the team and that can be submitted to the SEI as part of a TSP-PACE application.
Launch Data Summary	<p>The launch data summary should contain the following information:</p> <ul style="list-style-type: none"> • project name • team leader name and e-mail address • team coach name and e-mail address • launch date • organization name and address
Team Profile	<p>The team profile contains the following information for each member:</p> <ul style="list-style-type: none"> • name and qualification level (level of PSP/TSP training and certification achieved) • percentage of time assigned to the team • planned average individual weekly task hours • each team member's assignment duration (full project, project phase, number of months, etc.)
Meeting 1 Summary	<ul style="list-style-type: none"> • senior managers attending • customer representative attending, if any • number of visitors attending • any key person missing: team members, team leader, or coach • summary of management goals for the team <ul style="list-style-type: none"> – major deliverables and dates – resource constraints – other defined goals, including product and process quality goals
Meeting 2 Summary	<ul style="list-style-type: none"> • summary of team goals <ul style="list-style-type: none"> – key deliverables and dates – resource constraints – other defined goals • team member role and alternate role assignments
Strategy Summary	<p>List the key elements of the team's development strategy:</p> <ul style="list-style-type: none"> • number of releases • number of development cycles and their duration (days, weeks, months) • cycle scope (development only, through test, through customer use) • other (prototypes, customer testing, etc.)
Approved Development Plan Summary	<ul style="list-style-type: none"> • For the team's approved development plan, include a copy of the team's support tool with the plan summary. • If the tool does not provide such a summary, record the following data in an appropriate format for team use and/or for use within a TSP-PACE application: <ul style="list-style-type: none"> – major deliverables: size, delivery date – task hours by phase and total – number of team members – members to be added to the team or removed from the team and when – other key plan elements

Approved Quality Plan Summary	<ul style="list-style-type: none"> • For the team's approved quality plan, include a copy of the team's support tool with the plan summary. • If the tool does not provide such a summary, record the following data in an appropriate format for team use and use within a TSP-PACE application: <ul style="list-style-type: none"> – process quality measures and criteria <ul style="list-style-type: none"> ○ review rates, ratios, and yields ○ inspection rates, ratios, and yields ○ minimum required PQI (Process Quality Index) level for team release – product quality measures and criteria <ul style="list-style-type: none"> ○ defects injected and removed by phase ○ yield before first development (unit) test and before system test ○ defects/KLOC in system test and in the delivered product
Alternate Plans Summary	<p>If alternate plans are developed, then provide</p> <ul style="list-style-type: none"> • key deliverables and delivery dates • total task hours • total number of team members
Risk Evaluation Summary	<p>List the identified risks with high or medium impact and high or medium likelihood and list the team member that is assigned to track each risk.</p>
Meeting 9 Summary	<ul style="list-style-type: none"> • senior managers attending • customer representative attending, if any • number of visitors attending • any key person missing: team members, team leader, or coach • summary of management decisions <ul style="list-style-type: none"> – plan selected or any new planning guidance – any special tasking or assignments – other key actions or team guidance
Coaching Plan Summary	<p>List the key elements of the team coaching plan:</p> <ul style="list-style-type: none"> • when developed and reviewed with the team • coach post-launch availability • personal and role manager coaching • team activity participation (team meetings, inspection meetings, etc.)
Attachments and References	<ul style="list-style-type: none"> • Retain copies of the team plan. • Retain a copy of the team coaching plan. • Retain a copy, if available, of management and customer presentations in meeting 1. • Retain a copy of the team's presentation in meeting 9. • Retain copies of plan baselines from all launches, relaunched, and major changes to team commitments as documented in the TSP support tool.

Appendix B: TSP Postmortem Data Standard – Standard PM-Data

Purpose	<p>This Postmortem Data Standard guides teams in</p> <ul style="list-style-type: none"> • recording complete postmortem data in a retrievable way • retaining their postmortem data in a format suitable for later use <p>The postmortem data can be used by teams to</p> <ul style="list-style-type: none"> • compare team performance with the goals set during the launch • improve estimating accuracy and quality performance • provide data needed for a TSP-PACE • provide data needed for other types of appraisal or assessments
General	<ul style="list-style-type: none"> • This data is required for the postmortems held at the end of every project cycle and at project completion. • The recorder enters the data specified for each postmortem. • Where possible, these data are entered into the TSP support tool. • Where such data entry is not supported by the tool the team is using, the data must be recorded in a format that can later be used by the team and could be used as part of a TSP-PACE application.
Postmortem Data Summary	<p>The postmortem data summary should contain the following information:</p> <ul style="list-style-type: none"> • project name • team leader name and e-mail address • team coach name and e-mail address • postmortem date • organization name and address
Team Profile	<p>The team profile contains the following information for each member:</p> <ul style="list-style-type: none"> • name and qualification level (level of PSP/TSP training and certification achieved) • percentage of time assigned to the team • planned and actual average individual weekly task hours and total task hours • each team member's assignment duration (start and end dates)
Goal Performance Summary	<p>Provide a table summarizing the goal performance:</p> <ul style="list-style-type: none"> • Management's original goals (where defined) • The team's goals or approved plan • The actual results <ul style="list-style-type: none"> – For each goal, provide an assessment of how the team performed against it. – For quantifiable goals, provide the actual performance. – For goals associated with deliverables, provide the <ul style="list-style-type: none"> ○ planned and actual delivery date ○ planned and actual effort ○ planned and actual quality
Risk Mitigation Summary	<p>List the identified risks with high or medium impact and high or medium likelihood ratings together with any associated mitigations and whether mitigations were successful.</p>
Coaching Plan versus Actual Activities	<p>List the activities of the team coaching plan versus actual activities performed.</p>
Plan Summary	<ul style="list-style-type: none"> • Include a copy of the team's support tool's data with a summary of the team's planned and actual planning performance. • If the tool does not provide such a summary, record the following data in an appropriate format for team use: <ul style="list-style-type: none"> – major deliverables: size, delivery date – task hours by phase and total – number of team members – members to be added or dropped and when – other key plan elements

Quality Plan Summary	<ul style="list-style-type: none"> • Include a copy of the team's support tool's data with a summary of the team's planned and actual quality performance. • If the tool does not provide such a summary, record the following data in an appropriate format for team use: <ul style="list-style-type: none"> – Process quality measures and criteria <ul style="list-style-type: none"> ○ review rates, ratios, and yields ○ inspection rates, ratios, and yields – Product quality measures and criteria <ul style="list-style-type: none"> ○ defects injected and removed by phase ○ yield before unit test and before system test ○ defects/size measure in system test and in the delivered product
Completed Project Data	<ul style="list-style-type: none"> • Record the following defect data for every delivered product of every completed project: <ul style="list-style-type: none"> – final integration and system testing – customer acceptance testing – first six months of customer use – total customer defects reported to date • Record the customers/user profile for the product associated with this project. This should include the following: <ul style="list-style-type: none"> – total number of customers planned – number of customers using the product to date • Record any stakeholder survey results. Note when conducting surveys: <ul style="list-style-type: none"> – for products with limited usage, surveys should be sent to every user – for widely-distributed products, surveys should be sent to a randomly selected set of at least 100 customers/users – for products for which the customers are unknown (e.g., web sites), customer feedback provisions should be included in the products
Attachments and References	<ul style="list-style-type: none"> • Retain copies of the final team plan with actual data. The final team plan should include both team and individual data. • Retain copies of the team's and team members' weekly status reports including plan, actual, and cumulative: <ul style="list-style-type: none"> – task hours – earned value – hours for completed tasks

Appendix C: TSP Postmortem Report – Specification PM-Report

Purpose	<ul style="list-style-type: none"> • The postmortem report is used to record key data for each TSP project. • These data are typically needed by teams and their organizations to <ul style="list-style-type: none"> – estimate and plan subsequent projects – evaluate project performance against plan – establish future goals – improve process performance – demonstrate process adherence for a TSP-PACE or other types of appraisals or assessments
General	<ul style="list-style-type: none"> • Complete a postmortem report for every TSP project. • For multi-team projects, complete one overall report listing the unit teams and overall summary data with separate reports for each unit team. • Store the postmortem reports in a shared central TSP project data repository.
Project General Information	<p>List the following facts for each TSP project:</p> <ul style="list-style-type: none"> • project name with release, version, or other number as needed (If part of a larger project, give the larger project name) • TSP team leader or leaders • TSP team coach or coaches • number of TSP team members (all team members; not just programmers) <ul style="list-style-type: none"> – at initial team launch – at peak staffing • initial project launch date
Project Goals	<p>List the key goals and success criteria in terms of content, schedule, cost, and quality. Describe significant changes to project goals, scope, schedule, or resource.</p>
Project Environment Information	<p>Development environments (e.g., Rational, Microsoft Framework, etc.) Programming (e.g., languages, generators.) Management systems (e.g., change control, code control.) Support tools (e.g., TSP tools, testing tools)</p>
Product Delivery Data	<p>Give the plan and actual values for each of the following. For multiple deliveries, provide these data for every major product:</p> <ul style="list-style-type: none"> • customer delivery date • delivered product size • product function, features, or components
Plan and Actual Project Performance Data	<p>List the key project milestones committed, and planned and actual dates. If there are multiple releases, include the dates for each release. Include at a minimum</p> <ul style="list-style-type: none"> • launch and relaunch dates • code complete date • system test start and end • acceptance test start and end <p>Provide an overview of process data.</p> <ul style="list-style-type: none"> • total task hours, total development task hours, total review and inspection task hours, and total test task hours • total defects, total development defects, total system test defects, and total acceptance test defects • size (LOC, pages, etc.) for all products created or modified • if available, customer reported defects during <ul style="list-style-type: none"> – first year – product life • key project milestones (each launch, each phase start, and each phase end, etc.). • plan and actual dates for each milestone. • percent of project schedule spent in each phase.
Planning data	<p>Include the data and analysis from the Project Performance Summary.</p>

Process Improvement Data	<ul style="list-style-type: none">• goal performance analysis: the goal and the actual result• plan analysis: actual vs. planned productivity, defect rates and densities• process improvement analysis: performance improvement goals and PIPs for the process changes suggested to achieve these improvements
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Appendix D: TSP Project Performance Summary – Specification PPSUM

Purpose	This specification elaborates upon the analysis that can be provided in the Specification PM-Report.
General	<p>A thorough and complete project process and performance summary report will provide the</p> <ul style="list-style-type: none"> • data for planning future projects • basis for assessing and improving the process <p>The data provided in this summary should include average and range of performance.</p>
Effort Analysis	<p>To make accurate plans, you need to know the resource available for use on your project. In the resource section, describe</p> <ul style="list-style-type: none"> • number of staff assigned and applied • total project effort planned and actual • project effort planned and applied per week <p>Discuss significant changes in the effort applied and deviations from plan.</p>
Product Analysis	Discuss significant changes to the project requirements.
Activity Contents	<p>To make accurate plans, you need to know and understand the principal project activities to which project resources were applied and the resource required for each.</p> <p>In this section, list the key project tasks or phases and the hours spent on each.</p>
Process Planning Parameters	Based on the data from this and other projects, establish process planning parameters.
Production Rates	Assess the average and range of production rates for each process or major task. At a minimum, calculate the average, maximum, and minimum.
Process Phase Effort	<p>Complete a process performance summary for each unique process or sub process used to develop products.</p> <ul style="list-style-type: none"> • List each process phase and identify each phase as one of these types: <ul style="list-style-type: none"> – management – creation (e.g., design, code) – appraisal (e.g., review, inspection) – failure (e.g., unit test, acceptance test)
Process Defects	List the defect densities and injection and removal rates by process phase and/or system/sub-component.
Process Defect Removal	Provide phase yield data per defined process.
Component Data (optional)	<p>When planning, tracking and quality analysis is based on product components, list and describe the components and/or modules with their key data elements. This should include at a minimum the</p> <ul style="list-style-type: none"> • source language • size measure • actual and planned size • actual and planned effort • actual and planned defect density
Component Analysis (optional)	<p>When planning, tracking and quality analysis is based on product components, analyze the components to determine the components with the best and worst performance. This should include the following at a minimum:</p> <ul style="list-style-type: none"> • list of components in order of defect densities in system test • if you have the data, a list of the components and/or modules in order by defect densities for acceptance test or usage • a list or plot of the design, review, and inspection ratios and rates with every component and/or module

Size Analysis	To make accurate plans, you need to know the size of products produced by each process or process phase (assuming a correlation between size and effort). In this section, analyze the products produced by each key project task segmented by size measure or type. Compare plan versus actual size and update proxy tables if necessary.
Defect Analysis	Analyze the defects injected and removed in each process phase: <ul style="list-style-type: none"> • number of defects injected and removed in each phase by type • Pareto sort defect types by frequency • Pareto sort defect types by find and fix time • average and range of find and fix times in each phase
Phase Ratio Analysis	Determine the time ratios for all design, review, and inspection phases.
Inspection and Review Rate Analysis	Determine the review and inspection rates for every appraisal phase in your process.

Appendix E: TSP Project Change Record

Instructions

General

Use this form to record agreed and committed changes to the project plan. This form lists all important changes to the project goals and resources.

Include all changes to product delivery, product content, cost, and project resources.

Examples include, but are not limited to, adding or removing team members and change to product requirements or changing the delivery date.

Describe reasons for the change, the date the change was agreed to by the project sponsor or management, and the new commitment.

If the number of changes is too large, attach separate lists.

Terms used in this form

This table describes terms that are used in the accompanying *Project Change Record*.

Term	Description
Product	A component, feature, or other deliverable being produced by the project.
Revision date	The date changes to the project have been approved.
Previous Commit	The commit date being changed.
Revised Commit	The new commit date.

Description of form fields

This table provides instructions for completing each field in the form

Field	Description
Project Name	Provide the TSP project completed in the last three years that has delivered products to customers and/or users.
Project Change Description	Describe every change in project requirements or resources that results in a change to a delivery commitment.
Project names or Numbers	List the product or products affected by the change. <ul style="list-style-type: none">• For multiple products, list every product on a separate line.• Treat each separate product release as a separate product.
Revision date	For each change, enter the date the plan change was approved by the project sponsor or management.
Previous Commit Date	If a commitment date has changed, enter the previous baseline commitment date.
Revised Commit Date	If a commitment date has changed, enter the revised baseline commitment date.

Appendix E: TSP Project Change Record

Organization Name: _____

Date: _____

Project Name: _____

Project Change Description	Product	Revision Date	Previous Commit Date	Revised Commit Date
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