



# **Illuminating the Intersection of TSP and CMMI High Maturity Process Performance Models**

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22 September 2010



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# Agenda

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Challenge (& Business Case)

Research Hypotheses

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Illuminating the Intersection of TSP and Process Performance Models

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Next Steps & Call to Action

Q&A



# Introduction

Over the past 4-5 years, there have been several efforts to show the synergy and integration of CMMI and TSP.

Most recently, the TSP AIM project has defined ways to incorporate Six Sigma techniques with TSP for superior performance while pursuing CMMI maturity levels 2 and 3 in an accelerated fashion.

In parallel at one TSP adoption site (Hill ALC), a combined deployment of TSP and CMMI High Maturity process performance modeling resulted in leading discussions about the superior performance of the TSP and CMMI High Maturity intersection.

This presentation summarizes the thought progression on this synergistic intersection!



# Challenge (& Business Case)

Motivate the TSP community to adopt additional models that incorporate leading indicators (such as described later in this talk)

Motivate the CMMI community to consider the TSP and/or AIM implementation methods as an accelerated approach to CMMI higher maturity, including the rich process performance models easily attainable through TSP

Overall, imagine a collection of process performance models serving as an early warning radar system:

- Providing very early insight to brewing issues and obstacles!
- Enabling direct guidance for management and team preventive and corrective actions!
- Removing much of the remaining project guess work and enabling more time for creative work!



# Research Hypotheses

1. The factors identified from Watts Humphrey's "Leading TSP Teams" book can be practically measured by software teams
2. A subset of those factors are quite significant and powerful in predicting important performance outcomes
3. Models using these factors provide warnings of performance issues significantly earlier than currently practiced methods
4. Models using these factors provide greater insight to management and teams regarding the preventive and corrective actions to take
5. Software teams employing these "TSP-enriched" process performance models enjoy significantly greater performance of cost, schedule, quality and/or team morale and satisfaction



# Recap of TSP Measures



# Summary of TSP Launch Data

1. Basic project information such as project name, team name and start date
2. Team members, contact information, and their roles
3. Management and team goals, along with risks associated with those goals, classified by their impact and likelihood
4. Output products (e.g. software artifacts, documentation), along with estimated sizes and estimated number of defects injected
5. Estimated schedule information and available resources (hours per week)
6. A task list with estimated hours per task along with measures required for Earned Value Analysis (EVA)
7. Quality goals and possible defect types





# TSP Base Measures

Individual planning and tracking measures for each task:

1. Start and stop time
2. Interrupt time
3. Delta time
4. Task completion date

Quality data:

1. Date recorded
2. Defect ID
3. Output product
4. Type of defect
5. Injection and removal phase
6. Fix time
7. Fix reference, in case a defect is introduced while fixing another defect
8. Description



# TSP Project Measures

Derived measures at the TSP Project Level:

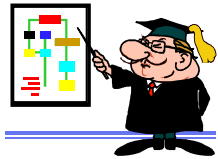
1. Process yield (the efficiency with which defects are removed from Products)
2. Defect injection and removal per phase
3. Defect density (Defects per KLOC, defects per page)
4. Time in phase



# Recap of CMMI Process Performance Models



# Purpose and Usage of Process Performance Models at the Organizational Level



- Identify Organizational Priorities for Quality and Process Performance
- Establishing and Revising Organizational Quality and Process Performance Objectives



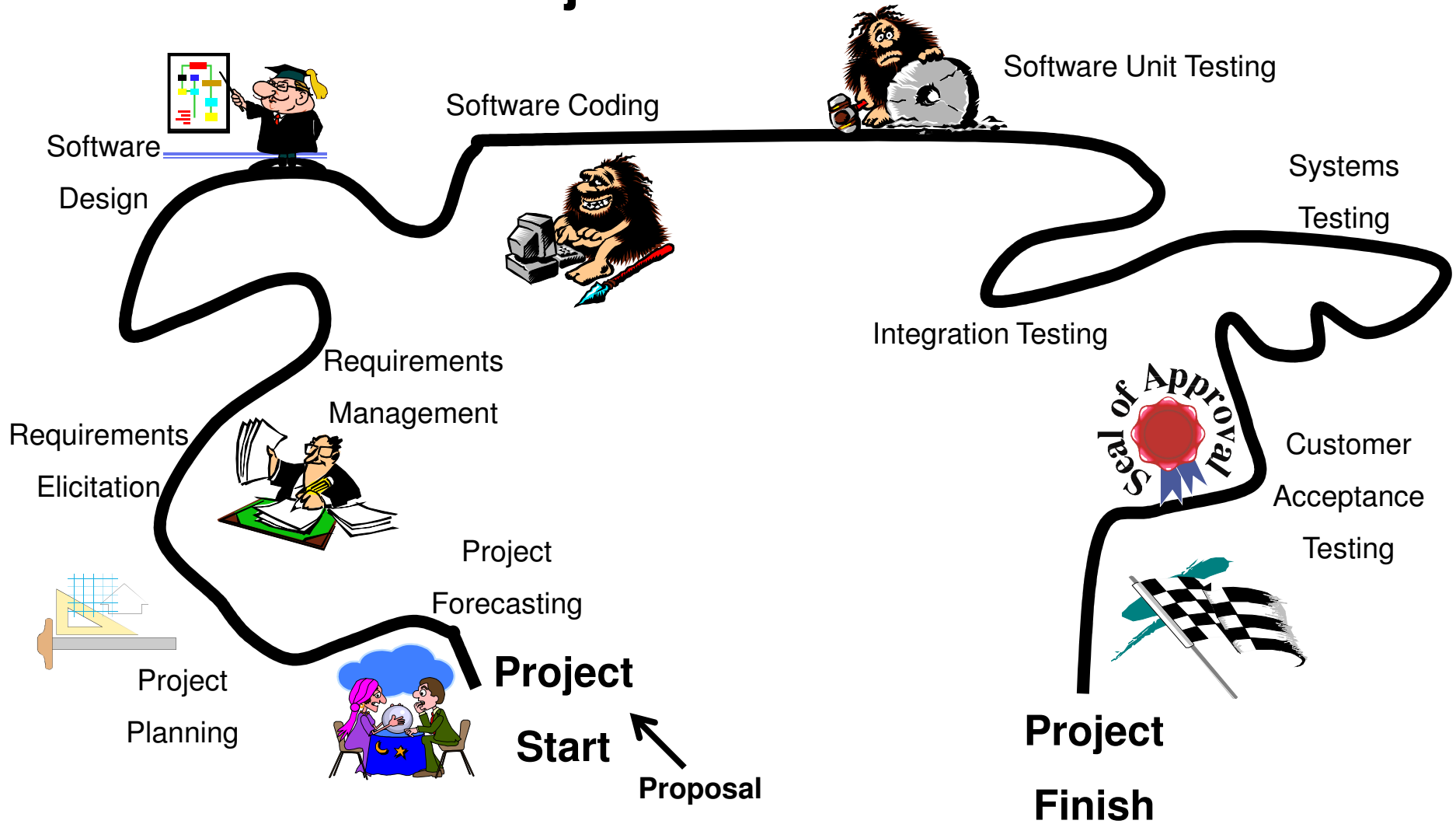
- Identification of Process Performance Measures
- Identification of New Process Performance Baselines



- Analysis of Process and Technology Improvement Proposals
- Identification of Process and Technology Improvement Proposals
- Prioritizing Candidate Process and Technology Improvements for Deployment



# Purpose and Usage of Process Performance Models at the Project Level



# Healthy Ingredients of CMMI Process Performance Models

1. Statistical, probabilistic or simulation in nature
2. Predict interim and/or final project outcomes
3. Use controllable factors tied to sub-processes to conduct the prediction
4. Model the variation of factors and understand the predicted range or variation of the outcomes
5. Enable “what-if” analysis for project planning, dynamic re-planning and problem resolution during project execution
6. Connect “upstream” activity with “downstream” activity
7. Enable projects to achieve mid-course corrections to ensure project success



# Examples of Outcomes

Escaped defects by phase\*  
Task duration  
Task effort  
Task delay  
Earned Value Metrics (CPI, SPI)  
Req'ts Volatility\*  
Customer Satisfaction  
Progress\*  
"ilities" such as Reliability  
Injected Defects Volume by type  
Availability of resources\*  
Cost Variance  
Schedule Variance  
Latent defect content of artifact\*  
Rework  
Cost of Poor Quality  
Time to Market  
Warranty Costs  
Difficulty\*  
Productivity\*



# Examples of Controllable People x factors

**Absolute performance of a task or topic**  
**Variability of performance of a task or topic**

**Training**  
**Skills**  
**Traits**  
**Interruptions**  
**Degree of Mentoring and Coaching**

**Staff Availability**  
**Experience Levels**  
**Degree of Multi-tasking**

**Geographic dispersion of staff**  
**Diversity of staff**  
**Attitudes and Outlooks**

**Communication Mechanisms**  
**Various Teaming Attributes**

**Knowledge Sharing Mechanisms**  
**Degree of Cross Training**  
**Multi-capable staff**  
**Organizational Dynamics**  
**Nature of Leadership**





# Example of Controllable Environmental x Factors

- Nature of work facilities
- Access to breakout rooms
- Proximity to team members
- Access or proximity to customers
- Access or proximity to suppliers
- Access or proximity to management and other stakeholders
- Other Visual or Audio Distractions
- Degree of noise or distractions
- External interferences including other organizations
- Ergonomics
- Temperature
- Accommodations for specific needs
- Available Training Rooms
- Degree of Security Classification



# Example of Controllable Technology x Factors

**Degree of modern development tools**  
**Newness of Technology**  
**Availability of Technology**  
**Documentation of Technology**  
**Programming Language Used**  
**Platform or Operating System Used**  
**Nature of Legacy or Reuse**

**Mature tools**  
**Degree technology proven**  
**Availability of equipment, test stations**  
**Complexity of Technology**  
**Newness of Technology**  
**Competition use of technology**  
**Technology Trends**  
**Technology Roadmap**



# Example of Controllable Process x Factors

Resolution time of technical inquiries	Quality of artifacts
Efficiency of a work task	(Input to or Output from
Compliance of a work task	a work task)
Quality of a work task	Timeliness of Artifacts
Timeliness of a work task	Task Interdependence
Measures of bureaucracy	Complexity of Artifacts
Resource contention between tasks	Readability of Artifacts
Difficulty of a work task	Any of the criteria for
Number of people involved with a work task	good reqts statements
Degree of Job Aids, Templates, Instructions	Any of the criteria for
Peer Review Measures	Choices of subprocesses
Test Coverage	good designs
Modifications to how work	Code measures
Measures	(Static and Dynamic)
Tasks are performed	



# Example of Controllable Customer, Supplier and Other Stakeholder x Factors

“Maturity” assessment  
Health of relationship  
Degree of communication  
Speed of feedback loops  
Trust  
Degree of oversight  
Degree of partnership, collaboration  
Geographic location  
Degree of access and participation  
Tradeoffs, Compromises, Optimization

Volatility of Staff  
Conflicts among Stakeholders  
Image and Perceptions  
Longevity of relationship  
Style  
Culture  
Domain Experience

Early Involvement  
Degree of Documentation  
of Expectations  
Complexity of relationship  
such as simultaneously a  
competitor and partner  
and supplier  
Bias on Quality vs Schedule  
Language



# Illuminating the Intersection of TSP and Process Performance Models



# Approach to Illuminating the Intersection

1. Begin with existing TSP measures
2. Understand the ingredients and purpose of CMMI Process Performance Models
3. Inventory the rich discussion of important factors and concepts included by Watts Humphrey in “Leading TSP Teams”
4. Begin developing ways to operationally measure these factors and concepts
5. Encourage leading TSP adopters to collect some of these new operational measures
6. Statistically determine which measures are significant in predicting various TSP project outcomes
7. Share operational models with the TSP community
8. Incorporate lessons learned from these models within TSP training



TSP Topic	“TSP Leading a Development Team” reference chapter	Rationale for the Leading Indicators
Leadership	Chapter 2	The attributes of the leadership of TSP teams and of organizations possessing TSP teams may be significantly predictive of the performance of the TSP teams.
Team Attributes	Chapter 3	The attributes and nature of self-directed teams may also correlate and provide leading insight to the performance of TSP teams.
Team Motivation	Chapter 4	The specific aspects and components of motivation of individuals and teams also may correlate and provide leading insight to the performance of TSP teams.
Building Teams	Chapters 5-7	The manner in which software teams are formed and launched may also correlate and provide leading insight to the performance of TSP teams.
Teamworking	Chapters 8-11	The manner in which software teams manage their work to the plan, deal with changing requirements, track progress, overcome obstacles, follow their processes and manage quality, collectively, may correlate and provide leading insight to the performance of TSP teams.
Relating to Management	Chapters 12-14	The degree and character of management support for software teams, as well as the nature and health of the relationship of the software teams to upper management, may also correlate and provide leading insight to the performance of TSP teams.
Maintaining the Team	Chapters 15-18	The specific aspects and attributes associated with developing and coaching software teams and individuals may also correlate and provide leading insight to the performance of TSP teams.



# Detailed Tables for TSP Leading Indicators

The 7 detailed tables of 130 unique, leading indicators gleaned from the “Leading TSP Teams” book may be seen in the Backup slides of this presentation

Additionally, a survey summarizing these leading indicators will be provided to you at the end of this talk.





# Example Process Performance Models within TSP



# Setup for Predicting Time-on-Task

The outcome to be predicted is the average time-on-task each week for each team member

Leading Indicators are:

1. Degree of well-defined roles (x1)
2. Degree of team trust and cohesion (x2)
3. Degree of team ownership of the process and plan (x3)

Each of these leading indicators are formulated as anonymous survey questions posed to the team members on a periodic basis (possibly weekly or monthly)

The survey questions involve an answer scale of 1=Low to 10=High  
Historical weekly snapshots were gathered from a number of teams




# The Model for Predicting Time-on-Task

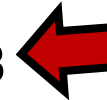
A team median (and 95% Confidence Interval of the team median) for each survey question is calculated. The median response of each question will be used as an “x” factor in a prediction equation.


The model is:

$$Y = 5.29 + 1.86(x1) + 1.17(x2) + 0.32(x3)$$

Given team values of:

x1 (Degree of well defined roles) = 8 

X2 (Degree of team trust and cohesion) = 3 

X3 (Degree of team ownership of process and plan) = 5 

Average predicted time-on-task per person per week = 25.28 hrs  
(The 95% Confidence Interval is roughly 18.5 hrs to 29.7 hrs)



# Using the Predicting Time-on-Task Model

The model may be used at any point after team launch to predict a given weekly time-on-task value.

TSP team leaders can conduct “what-if” analysis by changing the  $x_1$ ,  $x_2$ , and  $x_3$  values to determine changes in predicted time-on-task, ultimately deciding on specific values of the  $x$  factors that they will influence.

TSP team leaders can then use the predicted time-on-task values to adjust schedules.

If the average team time-on-task value for a given week drops below the predicted lower 95% Confidence Interval limit, then the TSP team leader should inquire about what special causes may be present to cause such unexpected low team time-on-task performance.



# Setup for Predicting Team Leadership Effectiveness

The outcome to be predicted is the value of the team leadership effectiveness on a scale of 1=Low to 10=High

Leading Indicators are:

1. Degree to which the team is confident of the Leader's vision (x1)
2. Degree to which the leader is perceived to take charge (x2)
3. Degree to which the team leader leverages individual strengths (x3)

Each of these leading indicators are formulated as anonymous survey questions posed to the team members on a periodic basis (possibly weekly or monthly)

The survey questions involve an answer scale of 1=Low to 10=High  
Historical weekly snapshots were gathered from a number of teams



# The Model for Predicting Team Leadership Effectiveness

A team median (and 95% Confidence Interval of the team median) for each survey question is calculated. The median response of each question will be used as an “x” factor in a prediction equation.

The model is:

$$Y = 0.73 + 0.35(x1) + 0.41(x2) + 0.19(x3)$$

Given team values of:

x1 (Leader Vision) = 6 

X2 (Leader Take Charge) = 8 

X3 (Leverage Individual's Strengths) = 7 

Predicted leadership effectiveness score for the current week = 7.44 out of a possible 10 points

(The 95% Confidence Interval is roughly 6.9 to 8.5)



# **Using the Predicting Team Leadership Effectiveness Model**

The model may be used at any point after team launch to predict a given team leadership effectiveness value.

TSP coaches and leaders can conduct “what-if” analysis by changing the  $x_1$ ,  $x_2$ , and  $x_3$  values to determine changes in leadership effectiveness, ultimately deciding on specific values of the  $x$  factors that they will try to influence.

TSP coaches and leaders can then use the predicted team leadership values to predict team performance at specific team product deliveries.

If the predicted team leadership effectiveness value for a given week or month drops below the predicted lower 95% Confidence Interval limit, then the TSP team leader and/or coach should inquire about what special causes may be occurring or how can the  $x$  factors may be better influenced.



# Setup for Predicting Team Quality Performance

The outcome to be predicted is the defect density of the software system during the upcoming internal system testing

Leading Indicators are:

1. Median of the Team weekly median time-on-task scores for the past 90 days prior to internal testing (x1)
2. Median of the Team Leadership Effectiveness scores for the past 5 months prior to internal testing (x2)
3. Defect density during internal system testing of the last completed system developed by the TSP team (x3)

The first two factors are derived from the example models that we just demonstrated. The third factor comes from historical quality data of the TSP team.





# The Model for Predicting Team Quality Performance

The model is:

$$Y = 1.75 - 1.12(x_1) - 1.32(x_2) + 7.8(x_3)$$

Given team values of:

x<sub>1</sub> (Median Time-on-Task Score for the Team) = 17 hrs 

X<sub>2</sub> (Median Team Leadership Effectiveness Score) = 6 

X<sub>3</sub> (Previous Product Defect Density during Internal Testing) = 8   
defects/KSLOC

Predicted team quality performance score (e.g. predicted defect density during internal test) = 37.19 defects/KSLOC

(The 95% Confidence Interval is roughly 30.2 to 45.7 defects/KSLOC)



# **Using the Predicting Team Quality Performance Model**

The TSP team may use the model at the point just prior to the launch of internal software system testing to ascertain whether the predicted defect density is too high to begin internal system test.

TSP teams can also conduct “what-if” analysis much earlier in the lifecycle by changing the  $x_1$ ,  $x_2$ , and  $x_3$  values and observing the resulting outcomes of anticipated defect density, ultimately deciding on specific values of the  $x$  factors that drive acceptable values of defect density during internal system testing.



# Final Notes on Process Performance Models

Models should provide either weekly or monthly updates that help drive informed decision-making

Models must measure  $x$  factors that have a granularity and opportunity to fluctuate on a weekly or monthly basis

By remaining observant and faithful to the above two principles, models will become practical and useful (e.g. many data points within a project)

Domain knowledge of which  $x$  factors are pertinent to your TSP team remains the most difficult aspect!

The statistical toolkit is the easiest part!

Final thoughts attributed to Douglas Hubbard:

“You always have more data than you think!”

“You always need less data than you have!”



# Next Steps

The authors wish to conduct a similar investigation of leading indicators at the PSP level

Both the PSP and TSP research will then be summarized in a future SEI Technical Report

Training in CMMI process performance modeling using the TSP-derived leading indicators to be developed and piloted



# Call to Action

The authors need your data! The TSP community needs your data!

We need TSP teams to collect the extra leading indicator measures for correlation with their team performance!

We also need TSP teams willing to pilot newly-developed process performance models and provide feedback on their use!

Please contact us with your interest!



# Contact Information

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# Backup Detailed TSP “x” Factors for Process Performance Models



# TSP Leadership Attributes

Candidate Leading Indicators	Potential Operational Measures
Effective and timely decision-making	Number of missed or late decisions; Impact of missed or late decisions
Leadership Vision	Vision articulated and communicated; Percentage of team unsure of vision; Percentage of stakeholders unsure of vision
Setting Direction via Goals	Goals clearly articulated and communicated; Percentage of team unsure of goals; Percentage of stakeholders unsure of goals
Leadership Motivation	Survey result of team members motivation by the team leader; Team Leader's self assessment of success of motivating team
Leadership Personal Commitment & Enthusiasm	Survey result of team members and stakeholders assessing the team leader personal commitment and enthusiasm; Survey and/or interview results of senior management assessment of the team leader personal commitment and enthusiasm
Leadership Taking Charge	Degree of well-organized and well-run team meetings; Degree of team crises embraced immediately by the team leader; Survey results of perceived leadership "take-charge" attribute
Leadership Leveraging Expertise within their team	Number of missed opportunities by the team leader to leverage expertise within the team; Degree to which team members perceive their expertise is not leveraged





# TSP Team Attributes

Candidate Leading Indicators	Potential Operational Measures
Common Goal	Degree to which all team members understand and can state the team common goal
Well defined team member roles	Degree to which team members perceive team member roles are well defined; Number of issues occurring due to a lack of well defined team member roles
Team trust and cohesion	Survey results of individual team members with regards to team trust and cohesion; Number of issues arising from insufficient team trust and cohesion
Sense of membership	Degree of positive feelings of team members regarding their team membership; Team member attrition initiated by the individual team member
Ownership of the process and plan	Survey results of team members evaluating their ownership of the process and plan; Number of team member unresolved issues voiced about the team process and plan; Degree to which team members feel free to voice dissent regarding the process and plan
Skill to make a plan	Number and percentage of team members skilled at making a team plan; A quantified total team experience level in years at making team plans
Discipline to follow the plan	Number of instances in which team members do not follow the plan; Degree to which team members exert peer pressure on other members to follow the plan
Dedication to excellence	Degree to which team members overtly subscribe to a dedication to excellence; Degree to which team members can quantify their personal improvement in the past 6-12 months
Team member training	Degree to which team member skills do not match their work assignments; Number of days of professional development achieved by team members during a given year



# TSP Team Motivation Attributes-01

Candidate Leading Indicators	Potential Operational Measures
Team placement on Maslow's Hierarchy of Needs	Position to which team members, the team leader and the team coach place the team on Maslow's hierarchy of needs; Degree to which non-self-fulfillment activity occupies the team member's focus, energy and time
Cognitive Dissonance	Survey result of team members; Evaluation results of external team coach
Feedback provided to team members	Survey result of team members; Number of improvement actions initiated by team member feedback
Fear and greed vs commitment, as motivation	Team member self evaluation via survey; team leader independent assessment; external coach assessment
Degree of negotiation within team	Team member self evaluation via survey; team leader independent assessment; external coach assessment; degree of time to reach team consensus; team members' attitudes toward negotiation
Degree of Agreement within team	Team member self evaluation via survey; team leader independent assessment; external coach assessment; Degree of issues resulting from a lack of team agreement
Degree of Performance within the team	Various objective measures of performance to include quality, schedule, budget, 360 degree evaluations
Voluntary team member commitment	Degree to which open discussion occurs leading up to commitment; body language as assessed by team leaders and coaches



# TSP Team Motivation Attributes-02

Candidate Leading Indicators	Potential Operational Measures
Visible team member commitment	Pro-active actions by team members exhibiting individual commitment; Degree to which team members help build commitment in each other
Credible team member commitments	Team member self evaluation via survey; team leader independent assessment; external coach assessment
Individual team member ownership of the plan	Degree to which team members exhibit ownership of the plan; Degree to which team members communicate and sell the plan to other stakeholders
Convert milestones into inchstones	Number or percentage of milestones that are planned with predecessor inchstones
Identify steps for each inchstone	Number or percentage of inchstones planned with further detail of steps of work
Regularly review team's progress against plan	Frequency of team progress reviews; Actions recorded by analyzing progress to plan; Survey of team members indicating satisfaction of frequency of reviews
Provide regular feedback on inchstones	Frequency of inchstone reviews; Actions recorded by analyzing progress to plan of inchstones; Survey of team members indicating satisfaction of frequency of reviews of inchstones
Take action to keep team perception that commitment is achievable	Coach evaluation of team leaders actions on this; Team leader self assessment of this; Survey results of team members satisfaction of team leader's actions to convince them the commitment is achievable; Number of times that the team perceives the commitment is not achievable



# TSP Building Team Attributes-01

Candidate Leading Indicators	Potential Operational Measures
Secure Management Agreement to needed resources	Degree of management agreement to needed resources perceived by the team leader; by the coach; by other stakeholders
Identify technical skills needed on team (Application domain, Product technology, Tools and Methods)	Degree to which the necessary skills for the project are identified in advance; Number of times the team finds itself short-handed from a skills standpoint; Impact of skills gap with the project needs in terms of budget, schedule, quality, etc...
Identify teamwork skills needed on team (Estimating and Planning, Quality Management, Interpersonal Behavior)	Degree to which the team leader assesses the teamwork skills needed on the team (percentage from a standard list of skills); Number of teamwork skills identified as a source of problems later in the lifecycle
Recruitment of team members with necessary skills	Degree to which recruitment of new team members is based on a skills checklist; Team member perceptions of skills match of new recruits; Recruit's reflections of their knowledge of the needed skills for the open position
Performance of Launch step 1: Establish Product and Business Goals	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 2: Assign Roles and Define Team Goals	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 3: Produce Development Strategy	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step



# TSP Building Team Attributes-02

Candidate Leading Indicators	Potential Operational Measures
Performance of Launch step 4: Build Overall and Next Phase Plans	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 5: Develop the Quality Plan	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 6: Build Detailed and Consolidated Plans	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 7: Conduct Risk Assessment	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 8: Prepare Management Briefing and Launch Report	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step
Performance of Launch step 9: Hold Management Review	Process compliance checklist; Survey participants and stakeholders for evaluation of the step; Number of actions arising from the launch step; Number of outstanding actions from previous launch steps when conducting this launch step; Coach evaluation of launch step



# TSP Building Team Attributes-03

Candidate Leading Indicators	Potential Operational Measures
Performance of the Launch Postmortem	Timeliness of the launch postmortem; Participation in the postmortem; number of issues and actions identified in the postmortem; degree to which lessons learned are ignored and re-experienced; impacts of not adhering to previous lessons learned
Team Performance of Data Gathering	Number or percentage of data gathering issues; degree of data quality issues; timeliness of data gathering within the team
Team Performance of Plan Tracking	Degree to which the plan is tracked against actual team performance; Survey results of satisfaction of team members and team leader with respect to this
Team Performance of Team Feedback	Frequency and quality of feedback provided to the team from external stakeholders; frequency and quality of feedback provided among team members
Team Performance of Load Balancing	Degree to which load balancing occurs or re-occurs; Number of team member complaints about load balancing issues; Degree to which load imbalances cause issues (qty and impact)
Team Performance of Replanning	Degree to which replanning occurs; Time since the last replan; time since the last request for a replan by a team member or stakeholder
Team members trained in PSP	Number or percentage trained in PSP; Number of years PSP experience within the team as a whole
Quality of the Team Member Selection Process	Degree to which existing team members participated in the team member selection process; degree to which the selection process was objective; degree to which a large net was cast in search of new team members; stability and longevity of team members once selected; new team member reaction to the selection process
Degree of trust built up when leader inherits a team	Degree to which the new leader builds trust with the team; Amount of face time a new leader has with the inherited team; Surveyed self assessments of trust from both the leader and the team members; Number of actions that exhibit trust



# TSP Building Team Attributes-04

Candidate Leading Indicators	Potential Operational Measures
Degree of trust built up when leader inherits a team	Degree to which the new leader builds trust with the team; Amount of face time a new leader has with the inherited team; Surveyed self assessments of trust from both the leader and the team members; Number of actions that exhibit trust
Team Member Skills Assessed	Degree to which skill assessment or testing is used; Degree to which solid references of skill performance are researched
Team Member Aptitudes Assessed	Degree to which team member aptitude is assessed; Degree to which solid references of individual aptitudes are researched
Team Member Interests Assessed	Degree to which team member interests are assessed; Degree to which solid references of individual interests are researched
Degree of cooperation among team members	Team leader and team member individual survey results of satisfaction of existing team member cooperation; number or percentage of time team member cooperation doesn't exist; number or percentage of issues caused by internal team cooperation issues
Degree to which leadership develops team members	Degree of 1-1 face time between team leaders and team members; number of development actions communicated to team members from team leaders; degree to which team member development is funded and supported
Degree to which team members are promoted and advanced	Degree to which team members are promoted or advanced as compared to filling with external candidates; time since last promotion or advancement of team members (individually and/or collectively); Degree of team member expression of dissatisfaction related to promotion or advancement; attrition rates related to this issue
Degree to which team building exercises used when needed	Number and type of team building exercises used within a team; survey results from team members on their satisfaction of sufficient team building exercises; number of times that lack of teaming is brought up as an issue during the lifecycle
Degree to which the team receives timely and effective coaching	Periodicity of feedback from a coach; quality of the feedback; corrective actions enabled from such feedback; team member assessment of the value of the coaching



# TSP Teamworking Attributes-01

Candidate Leading Indicators	Potential Operational Measures
Process compliance under stress	Number of process steps sacrificed during the lifecycle; during times of stress; impact of such violations
Dynamic planning when needed	Degree to which replanning is implemented when needed; Degree to which current plan is perceived by team members to be unrealistic due to lack of replanning
Impact analysis for all req'ts changes	Number or percentage of req'ts changes that are not accompanied by an impact analysis; Number of times that project issues arise due to improperly handled req'ts changes
Progressive elaboration of plans	Degree to which underplanning and overplanning are minimized in accordance with the principle of progressive elaboration; Number of points in which progressive elaboration occurs; the effort and time incurred with replanning due to lack of progressive elaboration
Workload balancing within the team	The number of times that workload imbalances cause team disruption, conflict or poor team performance; time required to rebalance the team; resistance of team members to workload balancing; number of times the team takes the initiative to look at workload balancing
Tracking team progress with EV and task hours	Degree to which EV and task hours are not used to track team progress; Degree to which lack of team progress information prevented timely team leader and/or management action to prevent undesirable outcomes
Obtaining help for the team	Number of times or situations in which the team needs help; Number of times that help is acquired; Number of times that requested help is not provided





# TSP Teamworking Attributes-02

Candidate Leading Indicators	Potential Operational Measures
Definition of Success by the team	Survey results of team members, leader and coach regarding the satisfactory definition of Success by the team
Setting and Maintaining Priorities	Number or percentage of the time that priorities are not set; Number or percentage of the time that team members perceive that priorities are not established
Establishing Short Term Goals	Number of Long term goals without corresponding short term goals; Degree to which team members, leader and coach do not perceive adequate short term goals in place
Overcoming Obstacles	Number and percentage of documented obstacles encountered by the team and overcome
Changing Direction	The number of times that the team leader worked to change direction of the team when needed; The number of times that the direction was changed unnecessarily
Involving the Customer	The amount of customer involvement, via face time, meeting time, telecons, number of inquiries or consults, technical inquiries with the customer
Process Fidelity (accuracy of following the process)	Using checklists, the number or percentage of items faithfully followed; Impact of negative outcomes resulting from process infidelity
Handling Process Problems	Number and percentage of process problems successfully handled monthly or per lifecycle phase; age of open process problems; time to resolve a process problem
Quality as top priority	Number and percentage of decisions in which quality was sacrificed or traded off; survey results of team member and leader perception of quality as top priority
Measurement of quality	Number and percentage of time that quality measures are not collected
Individual ownership of quality	Degree to which individuals on the team collect their own personal quality data and take action based on the analysis



# TSP Teamworking Attributes-03

Candidate Leading Indicators	Potential Operational Measures
Individual ownership of quality	Degree to which individuals on the team collect their own personal quality data and take action based on the analysis
Team ownership of quality	Degree to which the team collects quality data and takes action based on the analysis
Quality reviews planned	The number and percentage of quality reviews planned vs total possible; The degree of time planned for each team member to participate in quality reviews
Design and Coding Standards Used	The degree the standards are trained, communicated, used, monitored and updated
Quality reviews held	The number and percentage of quality reviews held; the number and type of actions resulting from the quality reviews
Defect reviews of test results	The number, type and percentage of defects found in testing; The number and type of defects predicted to be latent in the code
Quality analysis conducted	The frequency and completeness of quality analysis throughout the lifecycle; The number and percentage of effort hours expended on quality analysis; The number of actions resulting from the quality analysis
Reporting of Quality Data	The degree and timeliness to which quality data and results are reported to stakeholders; The frequency of the reporting; The stakeholder feedback on the usefulness of the reporting



# TSP Relationship with Mgt Attributes-01

Candidate Leading Indicators	Potential Operational Measures
Management Perception of Loss of Control over TSP team	Survey results from both team leaders and managers regarding the health of the relationship; The degree of friction or conflict between the team and the management
Management perception of insufficient resources	The degree of resources needed vs currently in place; the probability of the team exceeding the resource request; the track record for TSP team resource overruns in the past; the difficulty in attracting additional resources when needed
Management support for PSP training	The number and percentage of team members not trained in PSP; the training budget allocated for the team; the number of days per year allocated for team member training
Networking as a mechanism to resolve management issues	The number and percentage of significant issues that the team leader communicates and/or solves via networking within the organization; Number of issues not solved via networking
Management communication of team goals	The face time of management communicating with the team; The degree to which management communicates the importance of the team goals to the organization; Survey results on the team member evaluations of management communication
Management trust of the software team	Survey of management's trust in the software team; The number of times that management expresses a lack of trust in the software team; Survey results from the organization regarding management's trust in the software team
Periodic reports to Management	The number, frequency, timing, quality and usefulness of periodic reports to management
Communicating solutions corresponding to problems	The number and percentage of the problem situations when a problem is communicated without an accompanying proposed solution



# TSP Relationship with Mgt Attributes-02

Candidate Leading Indicators	Potential Operational Measures
Reports to Management meet their needs	Survey results of management satisfaction of team reports; Actions and decisions facilitated by the team's reports
Management requests are handled properly by the team	The number of management requests placed on the team; the number handled vs not handled; the impact of servicing the dynamic requests; the degree to which management or the team leader suffered a surprise
Multi-tasking imposed on team members	The number of tasks handled on average by the team members; The number of changed tasks in a given work day; the estimated amount of lost time due to changing tasks
Team member training available and utilized	The amount of training afforded to team members internally vs externally on an annual basis
Workspace	The degree to which team members raise complaints about the workspace; the lost time, rework, etc... resulting from workspace issues; the attrition of team members due to workspace issues; the cycle time required to remedy a workspace issue; the degree of preventive measures taken related to carpal tunnel syndrome, etc...
Data Confidentiality	The amount of training related to data confidentiality; the amount of process addressing data confidentiality; the number of breaches or misuses of data; team member perception of the degree of data confidentiality or lack thereof
TSP Leader balances priorities	The analysis of the coach and team members of the team leader's ability to balance priorities; the number and percentage of the time that the team leader fails to balance priorities; the impact of unbalanced priorities; the degree that the team leader seeks help to balance priorities



# TSP Team Maintenance Attributes-01

Candidate Leading Indicators	Potential Operational Measures
Team reassessments of common sense of membership	The frequency of revisiting the common sense of membership via survey or interview of team members; the degree to which signs exist of a lack of common sense of membership
Team Communication	The frequency and nature of team communications; the degree to which urgent vs non-urgent communication is conducted; the degree to which miscommunications disrupt team operations and cause conflict; the time spent by team members each day in communication
Frequent Team Meetings	The planning, efficient conduct and results of team meetings
Team Openly Resolving Issues	The number and percentage of issues not resolved after the first team meeting discussing the specific issues
Common Workspace	The degree that the team is collocated; sharing facilities; using common platforms and technology; the degree that workspace issues cause problems with the team operation and performance
Team reassessments of team goals	The frequency and need to reassess team goals; team member perceptions that team goals are overdue for reassessment
SMART and visual goals	The degree to which the team goals meet or don't meet the SMART criteria; The degree to which the team goals are depicted with status in a visual way, in the team work area
Team reassessments of team ownership	The frequency with which the team conducts a reassessment; the degree of team member perception that the reassessment is overdue
Team reassessments of team planning	The frequency with which the team conducts a reassessment; the degree of team member perception that the reassessment is overdue
Team reassessments of team quality commitment	The frequency with which the team conducts a reassessment; the degree of team member perception that the reassessment is overdue
Interest and Competence	The team leader and/or coach determination of the degree to which team member interest and competence remain high



# TSP Team Maintenance Attributes-02

Candidate Leading Indicators	Potential Operational Measures
Burnout	The degree of team member overtime; the degree to which team members eat meals in the office; the degree of team member attrition due to workload; the degree of stress that team members appear to be suffering; the degree to which abnormal and/or simple errors are made
Challenging Work	Survey results of team members depicting the degree to which their work challenges them; The degree of challenging tasks that team members assume outside of the current team's responsibilities
Professional Discipline	The degree to which team members view software engineering as a discipline; the degree to which team members participate in professional societies
Fairness	Survey result of perception from team members
Evaluations based on task and relationship maturity	From the coach and team member standpoint, the degree to which the team leader uses the proper style based on the task and relationship maturity of the situation
Individual measurement causing counterproductive behavior	The degree of counterproductive behavior occurring due to unwise or ill conceived measurement; the degree to which planned measures are subject to an FMEA analysis or Poka Yoke mistake proofing analysis
Coaching provided to individuals	Survey results from team members indicating their satisfaction of coaching provided by the team leader
Difficult team members properly handled	The effort and time expended to deal with difficult team members; the delay in dealing with difficult team members; the degree of successful conclusions in dealing with difficult team members
Handling poor performers	The degree of time that poor performers are dealt with properly by the team leader



# TSP Team Maintenance Attributes-03

Candidate Leading Indicators	Potential Operational Measures
Setting team improvement goals	The degree of participation of team members in establishing improvement goals; the freshness vs stagnation of improvement goals; the degree to which improvement goals challenge and stretch the team
Adopting a team improvement strategy and process	The degree of definition, documentation, communication, training and use of a team improvement strategy and process
Developing a team improvement plan with resources	The degree to which a team improvement plan has measureable and testable criteria; the degree to which the improvement plans are resourced and successfully achieve their goals; the degree to which management and the team willingly invest resources in future improvement plans
Providing team improvement measures and feedback	The degree that the improvement measures address the critical improvement needs; the clarity and timeliness of feedback such that team members may take early action; the degree to which the feedback is compelling and specific and actionable
Team benchmarking (measures, dynamic)	The frequency and target of benchmarking to meet organizational and team needs; The degree that benchmarking positively motivates the team and their performance
Strength of the Team Leader	Survey results of the team coach and team members; the track record of the team leader in leading successful projects; the difficult experiences that the team leader has under his/her belt

