

Lessons Learned in Seamless  
Integration of CMMI, TSP, and PSP  
Why All Three Are Needed

10th Annual Systems Engineering  
Conference

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# ais

**Advanced Information Services Inc.**

**Winner IEEE Software Process Achievement Award**

<http://www.sei.cmu.edu/managing/ieee-award/ieee.award.html>



# Topics

- Issues
  - ◆ Quality and Schedule
  - ◆ Rational Management and Commitment
  - ◆ Insanity and Malpractice
- Three Improvement Perspectives
  - ◆ Organization - CMM/CMMI
  - ◆ Individual – PSP
  - ◆ Team – TSP
- Seamless Integration of CMMI, PSP, TSP
  - ◆ The glue – Process Improvement Proposal
  - ◆ AIS Experience
- Lessons Learned

# Quality Is More Important Than Schedule

“In today’s software marketplace, the principal focus is on cost, schedule, and function; quality is lost in the noise. This is unfortunate since poor quality performance is the root cause of most software cost and schedule problems.”

Watts Humphrey

# Rational Management - Developers

- When pressed for early deliveries, the responsible team members say

“I understand your requirements, I will do my utmost to meet it, but until I make a plan, I can not responsibly commit to a date”

# Rational Management - Managers

- When pressed for early deliveries, the responsible managers say

“I trust you to create an aggressive and realistic plan, I will review the plan, but I will not commit you to a date that you can not meet”

# Rational Management - Principles

- Set challenging goals
- Get the facts
- Use facts and data
- Anticipate and address problems

# Insanity or Malpractice?

## Insanity

Doing the same thing over and over and  
expecting a different result

## Malpractice

An organization which does not have a  
top-management-sponsored  
continuous improvement initiative in place



# Organization Improvement Capability Maturity Model

Level	Focus	Key Process Areas (KPA)
5 <b>Optimizing</b>	Continuous process improvement	Defect prevention Technology change management Process change management
4 <b>Managed</b>	Product and process quality	Quantitative process management Software quality management
3 <b>Defined</b>	Engineering process	Organization process focus Organization process definition Training program Integrated software management Software product engineering Intergroup coordination Peer reviews
2 <b>Repeatable</b>	Project management	Requirements management Software project planning Software project tracking Software quality assurance Software configuration management Software subcontract management

# Comparing SW-CMM to CMMI

## SW-CMM key process areas

## CMMI Process Areas

**Level 5**  
*Optimizing*

Defect Prevention → Causal Analysis and Resolution  
 Technology Change Management → Organizational Innovation and Deployment  
 Process Change Management →

**Level 4**  
*Managed*

Quantitative Process Management → Organizational Process Performance  
 Software Quality Management → Quantitative Project Management

Organization Process Focus → Organizational Process Focus  
 Organization Process Definition → Organizational Process Definition  
 Training Program → Organizational Training  
 Integrated Software Management → Integrated Project Management  
 Software Product Engineering → Risk Management  
 Software Product Engineering → Requirements Development  
 Software Product Engineering → Technical Solution  
 Software Product Engineering → Product Integration  
 Intergroup Coordination → Verification  
 Peer Reviews → Validation  
 Peer Reviews → Decision Analysis and Resolution

**Level 3**  
*Defined*

Requirements Mgmt → Requirements Management  
 Software Project Planning → Project Planning  
 Software Project Tracking & Oversight → Project Monitoring and Control  
 Software Subcontractor Management → Supplier Agreement Management  
 Software Quality Assurance → Product & Process Quality Assurance  
 Software Configuration Management → Configuration Management  
 Measurement and Analysis

**Level 2**  
*Repeatable*

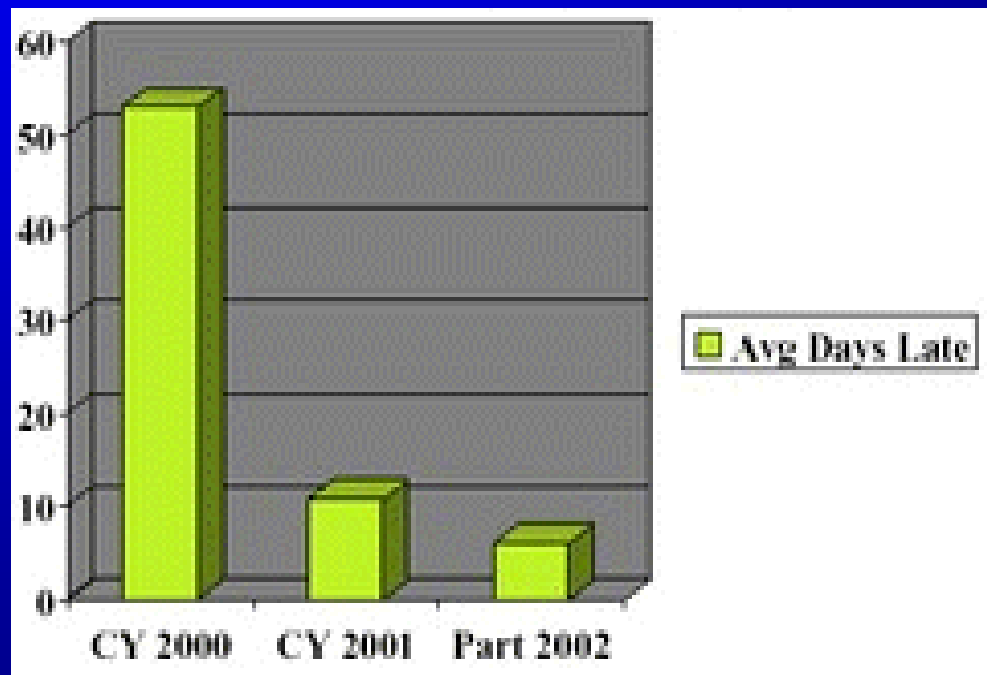


# Issues Addressed by CMM

- Getting management attention
- Maintaining long-term improvement focus
- Guiding the improvement work

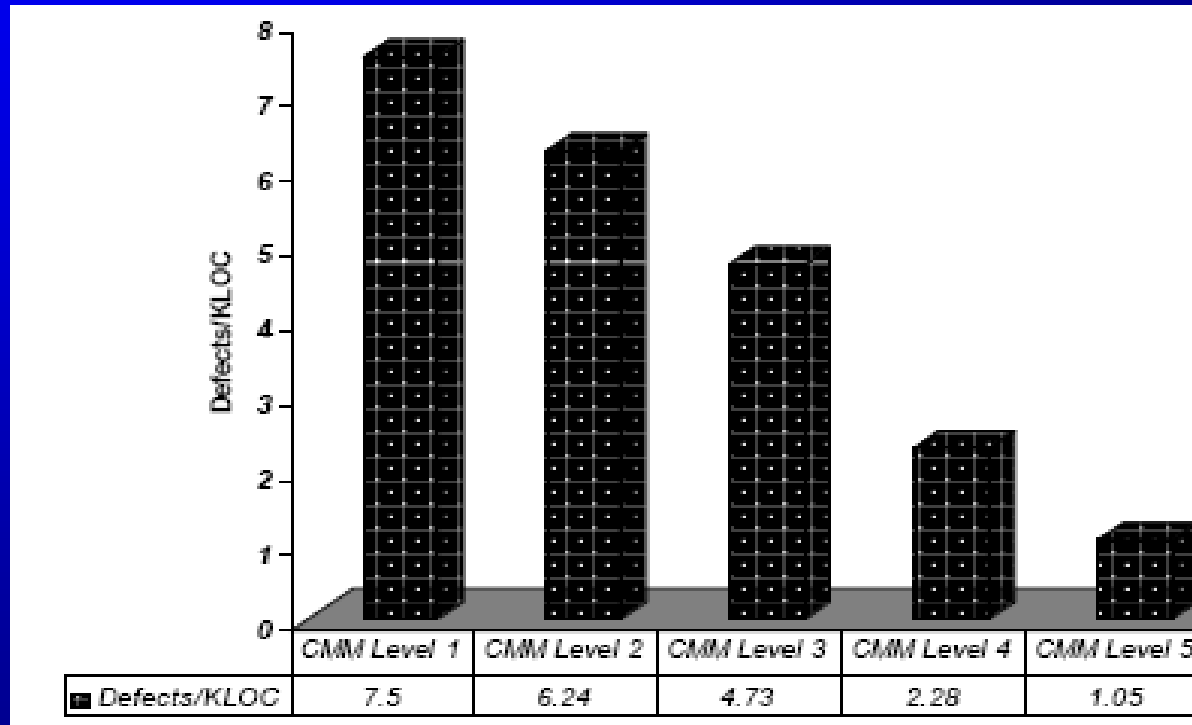
# CMM Results – Schedule GM

- Average number of days late in meeting milestones declined from over 50 days to fewer than 10 following organization focus on CMMI



General Motors Presentation, SEPG, Boston, MA, 2003

# CMM Results – Defects



# CMM Problems

- No simple model could precisely measure process maturity and complex models are not useful in guiding improvement
- CMM consciously focused on *what* organization should do, not on *how* they should do it
- The teamwork practices and personal disciplines required for quality software work are almost entirely issues of *how*, and not just *what*
- Because engineers will not change the way they work without very specific guidance, the CMM does not change engineering behavior

# The Real Need

- The need is not for lots of process data but for engineers who gather and use that data
- What would happen if software professionals used sound engineering practices?
  - made and followed detailed plans
  - gathered and used historical data
  - measured and managed quality
  - analyzed and improved their processes
- The need is for a Level 5 Process at the individual level

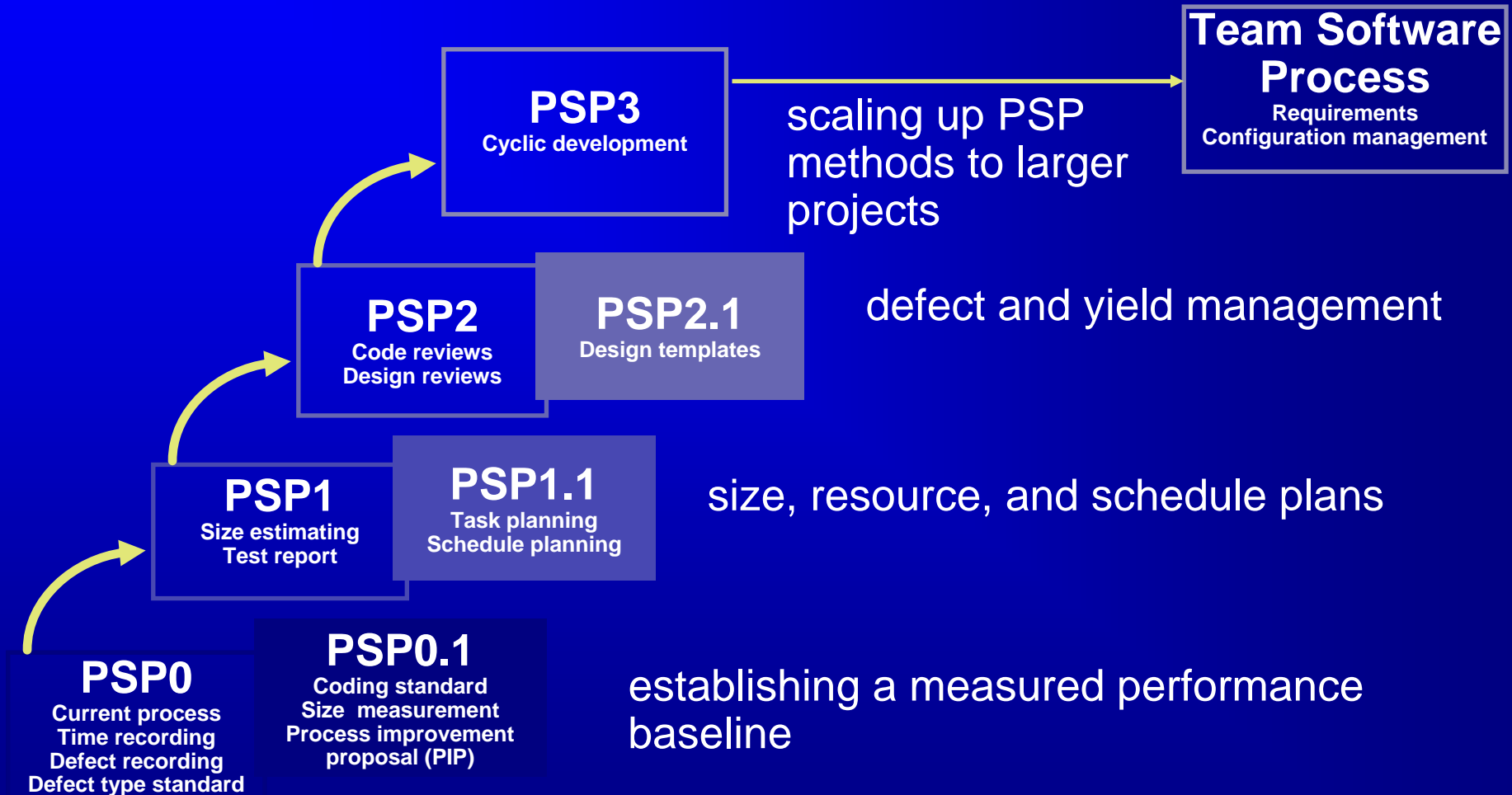
# Self Improvement From Project To Project

“You can not stand still, so you should treat every project as a way to build talent rather than merely treating your talent as a way to build projects”

Watts Humphrey



# Self Improvement Personal Software Process - 1



# Self Improvement

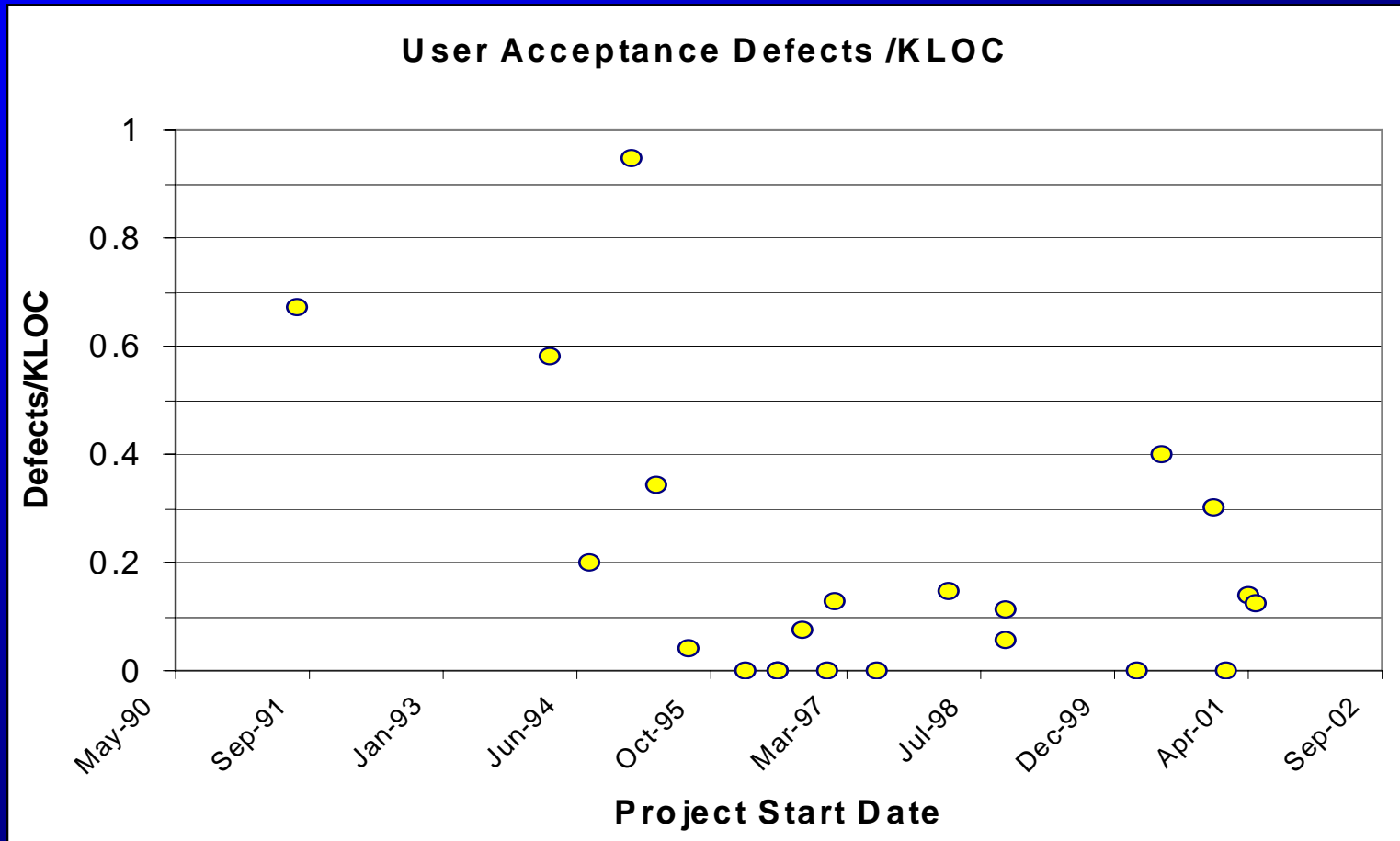
## Personal Software Process -2

- At the end of the PSP training, developers know how to:
  - ◆ Consistently gather size, time, and defect data
  - ◆ Make commitments based on historical data
  - ◆ Analyze personal data to answer questions
    - Where am I spending my time?
    - What are my common defects?
    - Where do I inject the defects?
    - What goals do I need to set to improve?



# PSP Results – Defects

## AIS



# PSP Problems

- To do quality work, engineers need a detailed plan and a defined process
- Without the process, they cannot make detailed plans, take consistent measurements, or track their work against the plan
- However, when engineers have a project to deliver, they are rarely willing to take the time to define a complex process, even when they know how

# The Real Need

- Need a mechanism to guide teams through defining their processes and making complete, precise, and detailed plans
- Need a vehicle to help organizations capitalize on the potential benefits of disciplined teamwork

# Team Improvement

## Jelled Teams

“The speed with which organizations form and deploy teams is the single most important factor in determining their competitive success”

“Jelled teams are the most powerful tool ever devised for doing challenging work”

Watts Humphrey



# Team Improvement

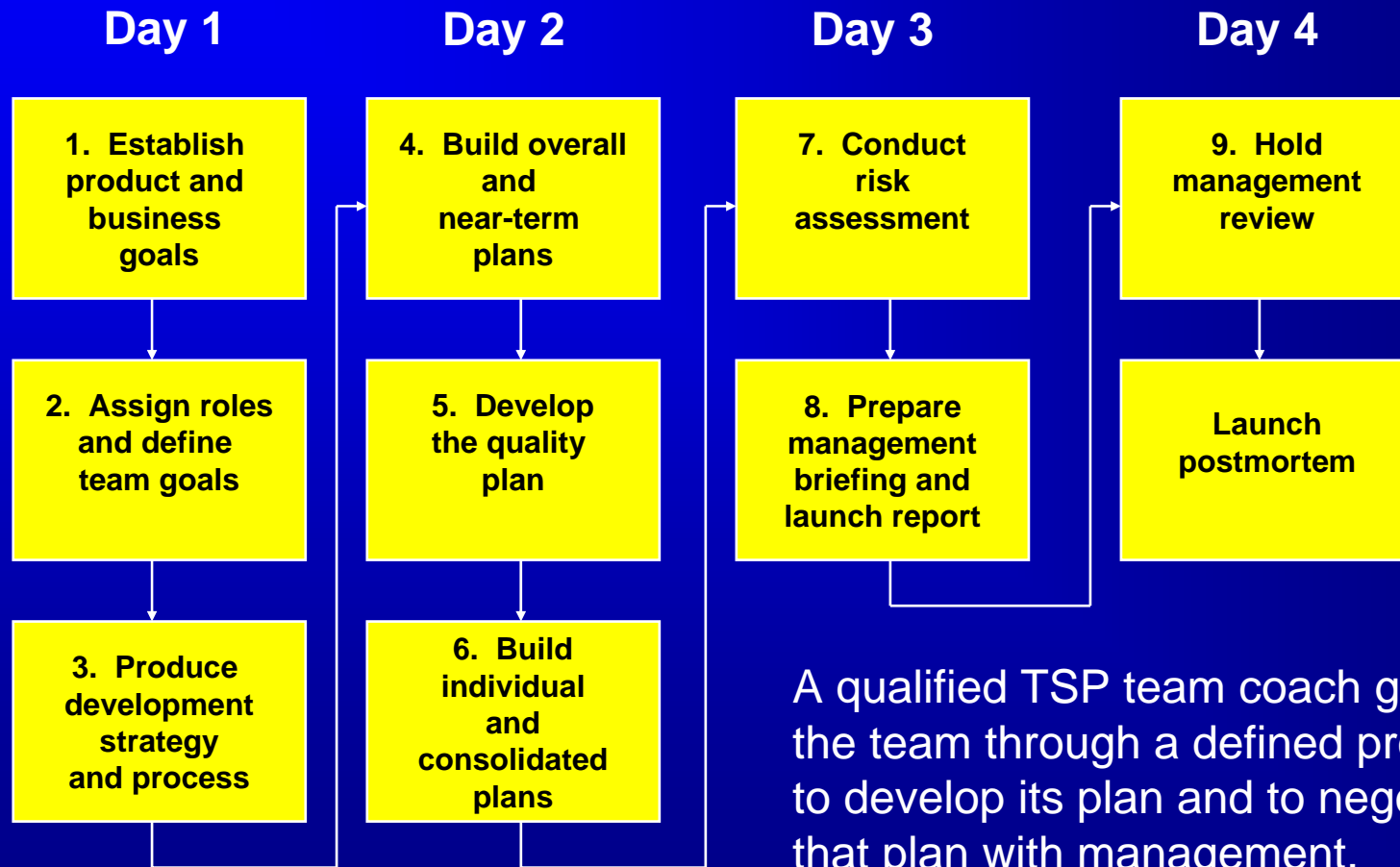
## Self-directed Teams

- Characteristics of self-directed teams
  - Sense of membership and belonging
  - Commitment to a common team goal
  - Ownership of the process and plan
  - The skill to make a plan, the conviction to defend it, and the discipline to follow it
  - Dedication to excellence



# Building Self-directed Teams

## The TSP Launch Process



# Self-directed Teams

## Project Tracking Issues - 1

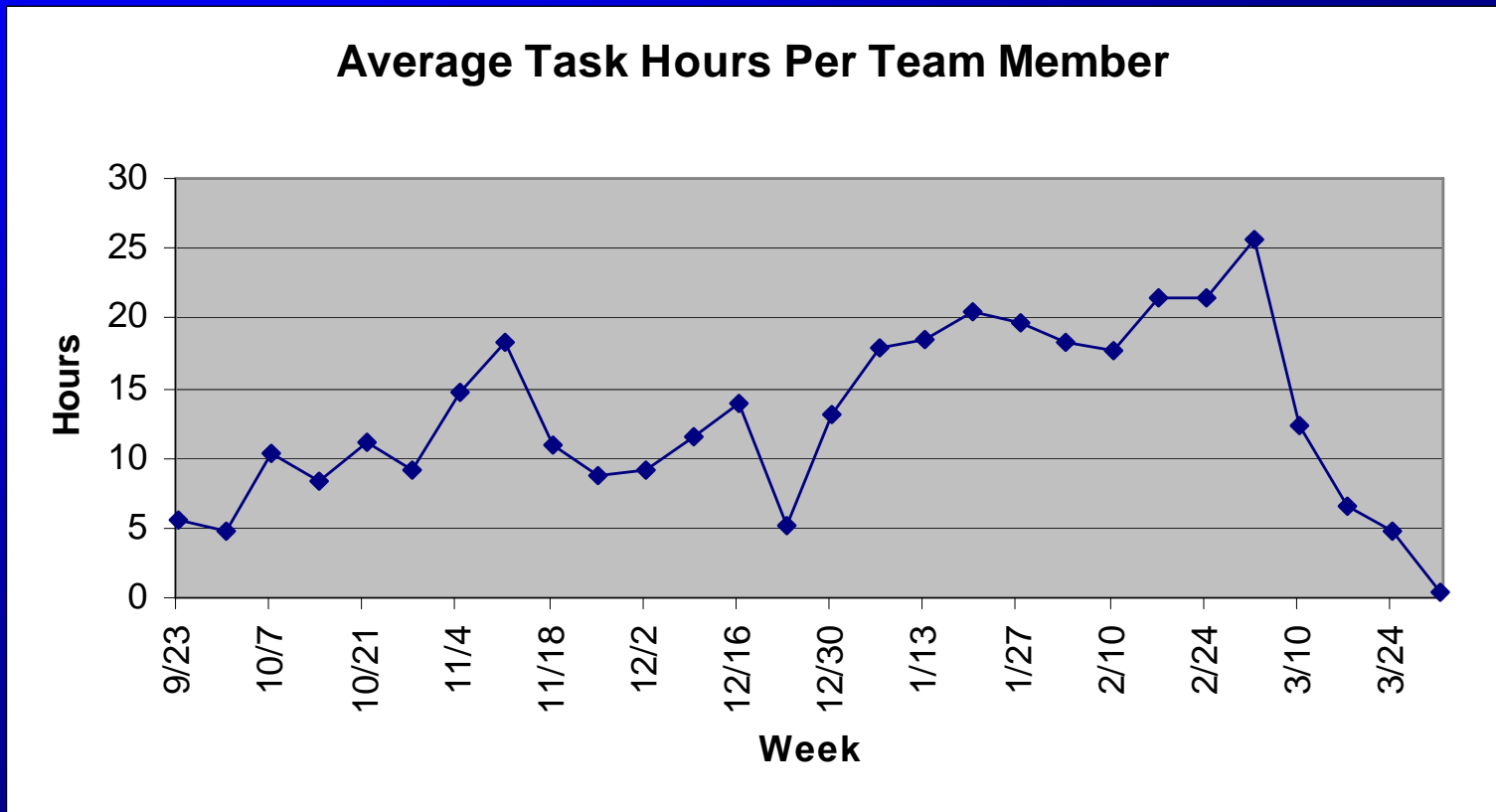
- With PSP training, developers know how to plan, schedule, and track their work
- TSP teams use these PSP-learned methods to make detailed plans
  - Tasks are no more than 10 task hours each
  - Task time is recorded daily
  - EV is measured weekly
- You can tell project status to within 10 task hours
- TSP teams regularly report their status

# Self-directed Teams

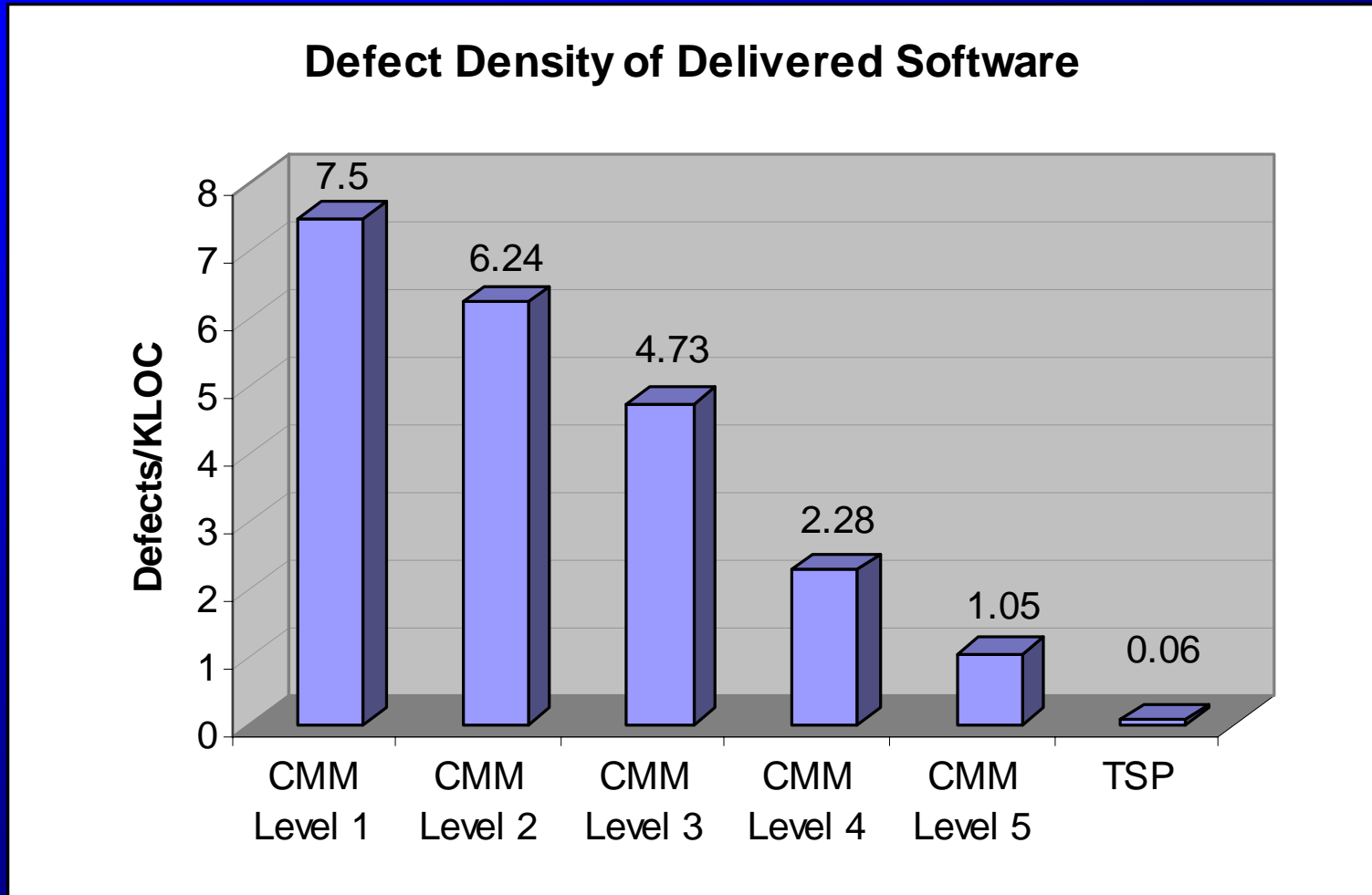
## Project Tracking Issues - 2

- Project schedules slip a day at a time
- If you cannot precisely measure project status, you will not know where projects stand
- Without such knowledge, you cannot address schedule problems in time to fix them
- With the TSP, you can
  - closely monitor team performance
  - address problems in time
  - consistently meet schedules

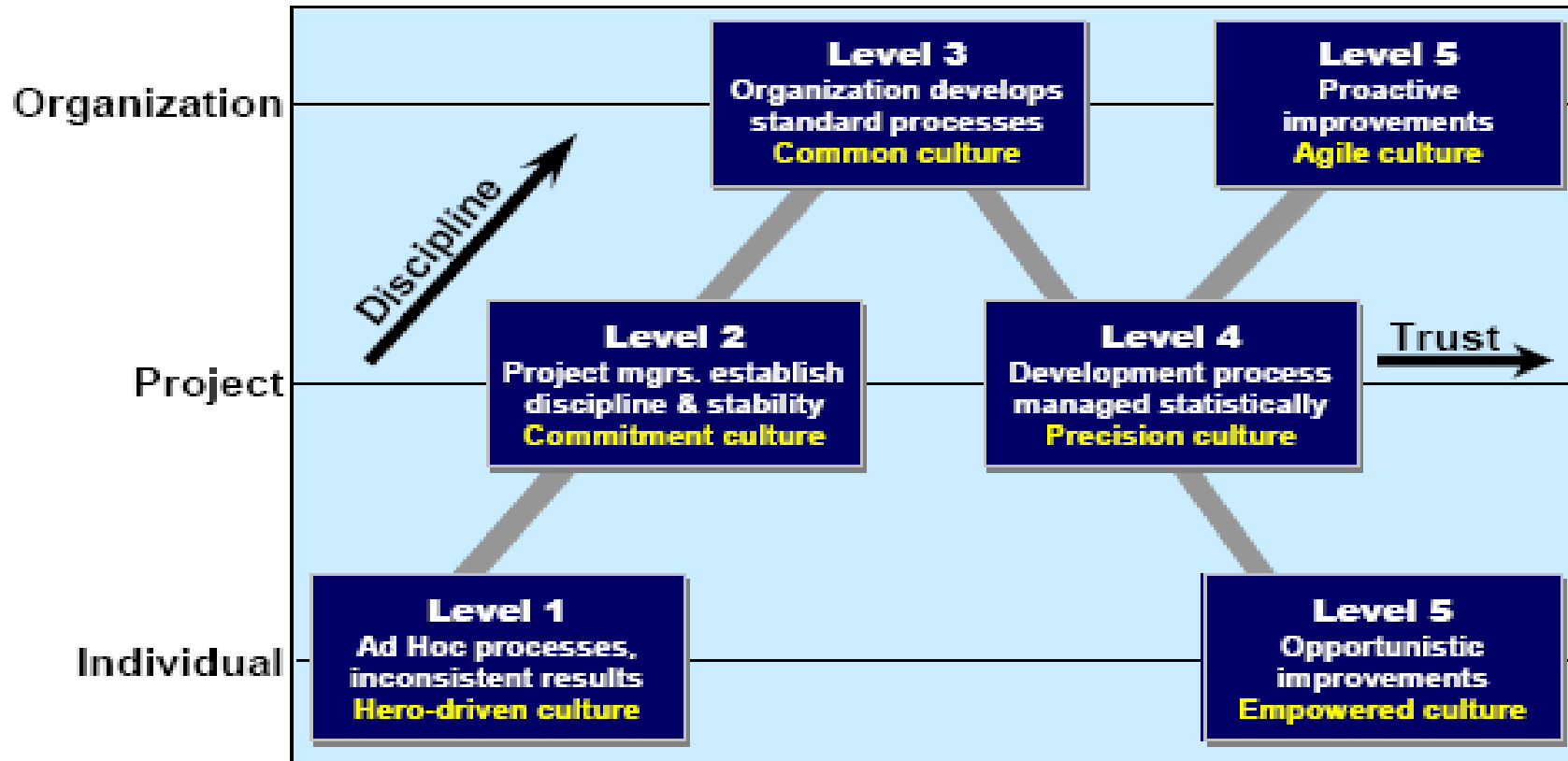
# TSP Results – Task Hours



# TSP Results - Defects



# Transforming the Culture



**Borland**

Source: "From MCC to CMM", Dr. Bill Curtis, DC SPIN, April 2006

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# Process Improvement Principles

- It takes time, skill, and money to improve the software process
- To improve the software process, someone must work on it
- Unplanned process improvement is wishful thinking
- Automation of a poorly defined process will produce poorly defined results
- **Improvements should be made in small steps**
- Train, train, train!

Source: *Managing the Software Process*, Watts Humphrey

# Empowered Culture

## Process Improvement Proposals (PIPS)

**PROCESS IMPROVEMENT PROPOSAL (PIP)**

**PIP# :**  
**Written By:**

**Date :**  **Author(s) :**  **Project :**

**Process Name :**  **Key Process Area :**

**Improvement Description :**

**Improvement Benefits (Check One) :**

<input type="radio"/> Document Improvement	<input type="radio"/> Reduced Cycle Time
<input type="radio"/> Improved Quality	<input type="radio"/> Reduced Risk

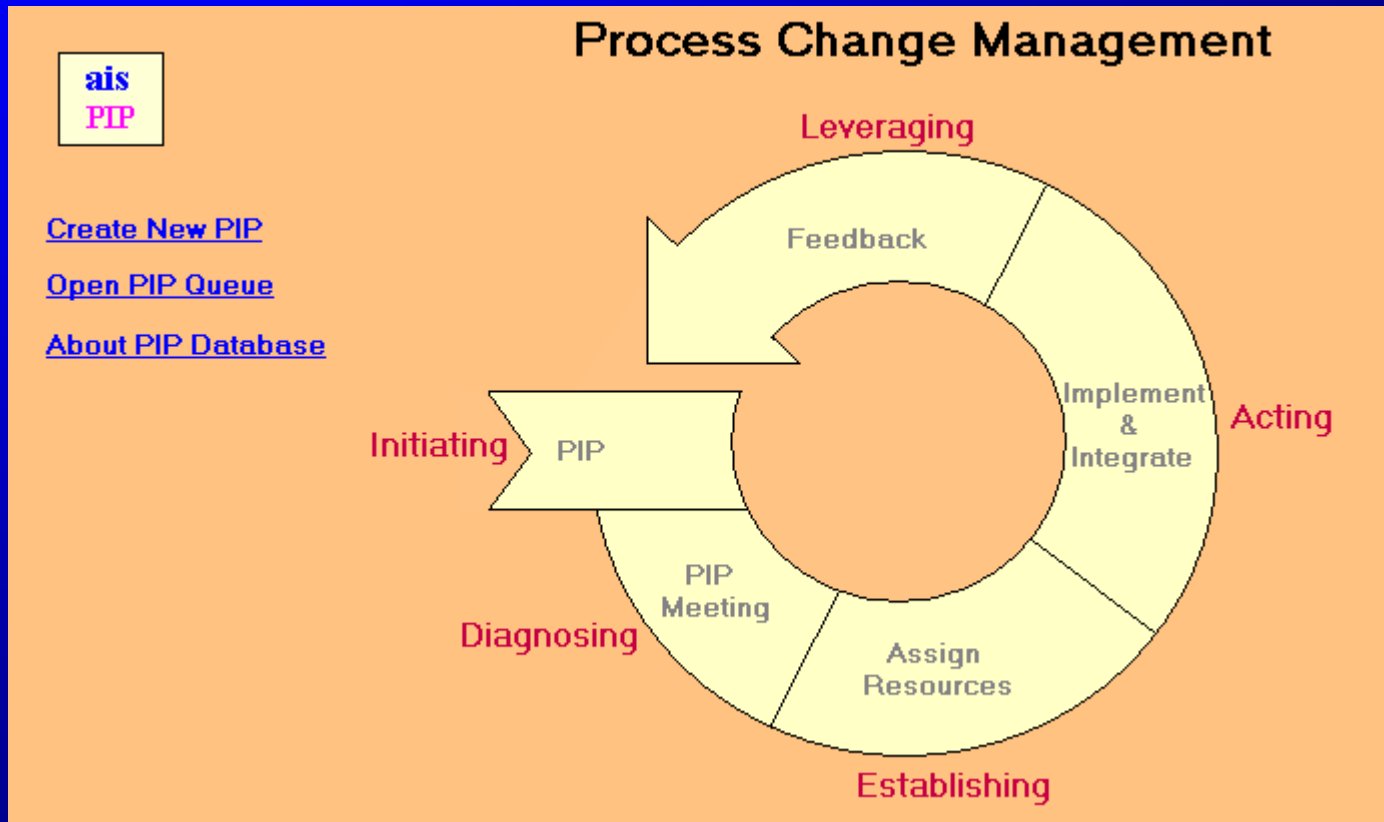
**Benefits Description (Quantify Where Possible) :**  
(Attach files if needed)

**Attach the PIP Pilot Report here (if applicable):**

▼ **SEPG Evaluation**



# The AIS PIP Process



# AIS PIPs Summary

Jan 22, 1992 – To date

No. of PIPs submitted	1502
No. of PIPs implemented:	972
No. of PIPs by improvement category:	
• Improved quality	232
• Reduced cycle time	86
• Reduced risk	63
• Improved documentation	161
• Not categorized	410

# Sample PIPs – Organization Process

- Incorporate the TSP into the AIS CPIW as suggested by the attached work products (ProjectCommitmentProcess.zip) which reflect the current practice
- Change Launch meeting 9A so that review is held, not only by management, but also peer Project Managers. Accordingly, these same individuals may need to be present in meeting 1B

# Sample PIPs – Team Process

- For UI component enhancements, change process to do Design Inspection, Test Case Inspections and Code Inspections after Compile
- For components where performance requirement is critical, execute two rounds of unit test
  - Unit test of performance test cases before code inspection
  - Unit test of features after code inspection

# Sample PIPs – Personal Process

- Reduce phase distribution % for Design Review for UI Components
- Update Personal Review Checklist
- Batch process E Mail three times a day
- Move end of day post mortem to start of day to process and analyze previous day's data

# Lessons Learned - 1

- While models are useful to indicate where improvements are needed, only committed people can make the improvements
- A supportive management environment that rewards disciplined behavior is absolutely essential
- Timely feedback on the status and disposition of the PIPs is important to sustain the PIP mechanism and feeling of empowerment
- Do not need to wait till level 5 to start implementing process change management

# Lessons Learned - 2

- While CMM is necessary as an organizational capability improvement model, it is not sufficient to change engineering behavior; the PSP provides the detailed “how to” for improvement at the individual level
- The TSP provides the management framework for continuously improving self directed teams. The PIP mechanism is key for team ownership of the project’s process and commitment to improve
- CMM, TSP, and PSP all three are needed for an integrated approach to model based improvement at the organization, team, and individual levels without the risk of sub-optimization

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