Implementing CMMI for High-Performance

CMMI Made Practical
London, April 2009
Topics

Maturity and performance
A high-performance improvement solution
SEI support
Maturity Levels and Performance

Many people believe that when you achieve a higher CMMI maturity rating that higher performance follows.

Achieving a higher CMMI maturity rating doesn’t guarantee higher performance

The performance you achieve will depend on your implementation of CMMI.
CMMI Models the “WHAT”

CMMI is a model not a process.

It describes characteristics of effective processes, not the processes themselves.

The trick is to translate the model into a high-performance, high-maturity implementation.

Also, to do this effectively and efficiently.
CMMI Implementation Challenges -1

There can be considerable performance variation in implementations of CMMI practices.

Why?

• The example practices don’t all have equivalent performance, e.g. informal reviews aren’t as effective as formal inspections.

• The same example practice can have substantial variation in performance, e.g. average inspection yield* can range from 30% to 70%.

• Complete, detailed, and timely performance metrics for the process are lacking and “what isn’t measured isn’t managed”.

Remember that satisfying a practice is no guarantee of performance.

*Yield is the percentage of defects found during the inspection
CMMI Implementation Challenges -2

CMMI is a model of organizational capability and so implementations tend to be focused at the organization level.

There is increasingly less focus on the processes of

• projects and teams
• individual managers and developers

What does organizational performance depend on?

It is a function of the process performance of the projects and teams which is a function of the process performance of the managers and developers.
CMMI Implementation Challenges -3

Process institutionalization is a key implementation challenge.

- coverage – the percentage of the organization that is using the process.
- process fidelity – the degree to which the process is practiced and measured as defined.

Example of impact on performance using inspections.

- Assume:
  - Only code inspections are conducted (process design flaw)
  - Only half the modules are inspected (process fidelity issue)
  - Only half of the projects are using the process (problem with coverage)
  - Inspection yield is only 30% (poor inspection practice)

- Only about 75% of the defects will be found before system test instead of the 95% that would be found if inspections were fully implemented.
- Cost to the organization…about 10 times more defects to find and fix in system test.
Implementing CMMI: Time to Move Up

Number of months to move to next maturity level

Largest observed value that is not an outlier

75th Percentile

25th Percentile

Median

Smallest observed value that is not an outlier

Recommended time between appraisals

Time Period of Initial Appraisal

Level

Orgs

1 to 2  2 to 3  3 to 4  4 to 5

12  99  22  16

1  2  3  4

1  2  3  4

5  55  6  8

5  15  28  24

All (2002 to Present)
Topics

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Implementing CMMI for High Performance

“The big issue is implementation” - William Peterson, Director SEI’s SEPM program

TC-AIM is a packaged solution to the challenges of implementing a high-performance instance of CMMI practices.

It provides

- Clear and obvious performance improvement with higher maturity
- Reduced variation from project to project
- Higher initial fidelity leading to institutionalization
- Improved cost/benefit or return on investment
- Reduced time and cost to achieve higher maturity
Foundations of the Solution

The “What” – Quality Principles

The “How to” – Appraisal methods, operational practices, improvement techniques, M&A Tools,
The “How-to” Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>How to…</th>
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</table>
| Appraisal Methods        | • Baseline maturity  
                          | • Identify strengths and weaknesses  
                          | • Support improvement planning  
                          | • Certify organizational process maturity (SCAMPI A)                                                                                  |
| SCAMPI A, B, C           |                                                                                                                                         |
| TSP and PSP              | • Implementation of a high-performance process framework that includes 70% of the CMMI practices and measures through ML5  
                          | • Implementation of a measurement framework through ML5  
                          | • Build self-directed teams  
                          | • Strategy for accelerating CMMI implementation  
                          | • Improve team and individual performance                                                                                             |
| Measurement and Analysis Tools |                                                                                                                                           |
| Six Sigma                | • Analyze data and identify improvement opportunities  
                          | • Define improved processes and measures  
                          | • Define goals and measures  
                          | • Improvement tools for EPG                                                                                                           |
| GDM                      |                                                                                                                                         |
Integrating the “How-to” Technologies -1

Appraisal Methods
- SCAMPI A
- SCAMPI B
- SCAMP C

Organization's Process

Team Software Process & Personal Software Process

Measurement & Analysis Tools
- GDM
- Six Sigma

Capability and performance gaps
Implementations of CMMI practices
Measurement standards and data
Improvements
Improvement opportunities
## Integrating the “How-to” Technologies -2

<table>
<thead>
<tr>
<th>SCAMPIs</th>
<th>Used by Process Group to guide improvement cycles</th>
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</table>
| TSP and PSP | Used as implementation of CMMI practices, or to augment existing practices to improve performance and achieve higher maturity.  
Introduces self-direct team management style required for high performance teams. |
| Measurement and Analysis Tools | Six Sigma approach is used by Process Group and other participants on Six Sigma improvement project teams. These teams also use the TSP self-directed team management style.  
Goal-Driven Measurement concepts are used to link organizational goals with TSP measurement framework. |
Implementing CMMI with TSP and PSP

- **CMMI** - for organizational capability
- **TSP** - for quality products on cost and schedule
- **PSP** - for individual skill and discipline
TSP Coverage of CMMI By Maturity Level

- **Unrated** - out of scope for TSP.
- **Not addressed** - project practice that TSP does not cover.
- **Partially addressed** - project practices that TSP addresses with some weakness of omission.
- **Supported** - organizational practices that TSP supports.
- **Directly Addressed** - TSP practices meet the intent of the CMMI specific practice (SP) without significant reservations.
TSP Effort (Cost) and Schedule Performance

From a study published in 2000

- fifteen projects in four organizations
- CMM ML1, ML2, ML3, and ML5
- TSP improved effort and schedule predictability at all maturity levels

<table>
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<tr>
<th>Effort (Cost) Performance</th>
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<tbody>
<tr>
<td>Study baseline</td>
</tr>
<tr>
<td>TSP</td>
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<table>
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<tr>
<th>Schedule Performance</th>
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<tbody>
<tr>
<td>Study baseline</td>
</tr>
<tr>
<td>TSP</td>
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</tbody>
</table>

Source: CMU/SEI-TR-2000-015
TSP Product and Process Quality Performance

An analysis of 20 projects in 13 organizations showed TSP teams averaged 0.06 defects per thousand lines of new or modified code.

Approximately 1/3 of these projects were defect-free.

These results are substantially better than those achieved in high maturity organizations.

Source: CMU/SEI-2003-TR-014
TSP System Test Performance Range and Average

Source: CMU/SEI-TR-2003-014
NAVAIR AV-8B TSP/CMMI Experience

AV-8B is a NAVAIR System Support Activity.

They integrate new features into the Marine Harrier aircraft.

They used TSP to reduce the time to go from CMM Level 1 to CMM Level 4.

Similar results can be achieved with CMMI.

SEI Average 6 Years

AV-8B 2.5 Years
# TSP in High Maturity Settings

<table>
<thead>
<tr>
<th></th>
<th>Project A (TSP/PSP)</th>
<th>Project B</th>
</tr>
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<tbody>
<tr>
<td>Size (KLOC)</td>
<td>82</td>
<td>151</td>
</tr>
<tr>
<td>Duration (months)</td>
<td>31.8</td>
<td>43.0</td>
</tr>
<tr>
<td>Normalized (per KLOC)</td>
<td>$0.95K</td>
<td>$4.05K</td>
</tr>
<tr>
<td>Developer Density</td>
<td>9.4</td>
<td>17.3</td>
</tr>
<tr>
<td>Peer Review Exit Density</td>
<td>4.78</td>
<td>17.3</td>
</tr>
<tr>
<td>Delivered Defect Density</td>
<td>1.55*</td>
<td>5.27</td>
</tr>
<tr>
<td>Integration / Acceptance Test Cost</td>
<td>$78.K</td>
<td>$612K</td>
</tr>
<tr>
<td>Time to Accept (months)</td>
<td>3.7</td>
<td>14.6</td>
</tr>
<tr>
<td>Normalized (months per 100 KLOC)</td>
<td>4.5</td>
<td>9.7</td>
</tr>
</tbody>
</table>

*only 20% of the code modules were inspected*

Topics

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## Phased Approach

<table>
<thead>
<tr>
<th>Pre-implementation analysis &amp; baseline</th>
<th>Implementation</th>
<th>Post-implementation analysis &amp; baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work with customer to</td>
<td>Implementation strategies:</td>
<td>Work with customer to</td>
</tr>
<tr>
<td>- define outcomes and success measures</td>
<td>- build a new organization, using a project-based improvement focus, starting with early adopters</td>
<td>- evaluate outcomes</td>
</tr>
<tr>
<td>- develop implementation strategy</td>
<td>- train top-down; from sr. management → middle management → software factory floor</td>
<td>- analyze performance and determine benefits</td>
</tr>
<tr>
<td>- baseline performance</td>
<td>- implement bottom-up</td>
<td>- appraise maturity and document improvement</td>
</tr>
<tr>
<td>- baseline process maturity</td>
<td>- add organizational improvement as needed to support the new projects</td>
<td>- identify next steps and repeat</td>
</tr>
<tr>
<td>- identify gaps</td>
<td>- use self-directed team management style (with coaching) and self-directed team concepts for development teams (TSP) and improvement teams (TSP + Six Sigma)</td>
<td></td>
</tr>
<tr>
<td>- develop implementation plan</td>
<td>- minimize days in training; courses target specific audience; one course per audience except EPG</td>
<td></td>
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<tr>
<td></td>
<td>- “Honor what’s working” by integrating improvements with existing practices where possible</td>
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<tr>
<td></td>
<td>- Certify/authorize internal staff in key technologies e.g. TSP/PSP, CMMI, SCAMPI, CMMI-Six Sigma</td>
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</table>
## Schedule of Activities and Deliverables

<table>
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<tr>
<th>Pre-implementation analysis &amp; baseline</th>
<th>Implementation</th>
<th>Post-implementation analysis &amp; baseline</th>
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<tbody>
<tr>
<td><strong>SCAMPI C</strong></td>
<td><strong>Introduction and Trial-use</strong></td>
<td><strong>SCAMPI A or B</strong></td>
</tr>
<tr>
<td>- integrate CMMI and People CMM?</td>
<td>- Executive Training (Sr. management)</td>
<td>- integrate CMMI and People CMM?</td>
</tr>
<tr>
<td>- TSP gap analysis to identify gaps from SCAMPI that are not covered by TSP</td>
<td>- Introduction to CMMI (EPG)</td>
<td><strong>Performance baseline</strong></td>
</tr>
<tr>
<td><strong>Performance baseline</strong></td>
<td>- Introduction to People CMM (EPG)</td>
<td>- cost/schedule predictability</td>
</tr>
<tr>
<td>- cost/schedule predictability</td>
<td>- Leading development teams (Middle and line management)</td>
<td>- productivity</td>
</tr>
<tr>
<td>- productivity</td>
<td>- PSP (EPG, development team members)</td>
<td>- system test product quality</td>
</tr>
<tr>
<td>- system test product quality</td>
<td>- Coach training (EPG)</td>
<td>- delivered product quality</td>
</tr>
<tr>
<td>- delivered product quality</td>
<td>- GDM (EPG)</td>
<td>- customer satisfaction</td>
</tr>
<tr>
<td>- customer satisfaction</td>
<td>- IPPSS or Six Sigma training (EPG)</td>
<td>- employee satisfaction</td>
</tr>
<tr>
<td>- employee satisfaction</td>
<td>- For each project, implement, launch and coach teams for trial piloting period. Refine and repeat</td>
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</tr>
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</table>

**Adoption and Institutionalization**

Train internal change agents

- CMMI – Intermediate; Instructor; Lead Appraiser
- People CMM – Intermediate; Instructor; Lead Appraiser
- TSP – Instructor; Coach

Train and launch development teams

Identify and implement improvement teams
Questions