Process Improvement (CMMI)

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Contents

- Need for Process Improvement
- CMMI Models
- Continuous View of CMMI
- Staged View of CMMI
The Role of Process

- Everyone realizes the importance of having a motivated, quality work force and the latest technology, but even the finest people can’t perform at their best when the process is not understood or operating at its best.
Common Misconceptions

☐ I don’t need process, I have
  - really good people
  - advanced technology
  - an experienced manager

☐ Process
  - interferes with creativity
  - equals bureaucracy + regimentation
  - isn’t needed when building prototypes
  - is only useful on large projects
  - hinders agility in fast-moving markets
  - costs too much
Symptoms of Process Failure

☐ Commitments consistently missed
  ▪ Late delivery
  ▪ Last minute crunches
  ▪ Spiraling costs

☐ No management visibility into progress
  ▪ You’re always being surprised

☐ Quality problems
  ▪ Too much rework
  ▪ Functions do not work correctly
  ▪ Customer complaints after delivery

☐ Poor morale
  ▪ People frustrated
  ▪ Is anyone in charge?
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Capability Maturity Model® Integration

- A CMMI model provides a structured view of process improvement across an organization

- CMMI can help
  - integrate traditionally separate organizations
  - set process improvement goals and priorities
  - provide guidance for quality processes
  - provide a yardstick for appraising current practices
CMMI Models

- Four Disciplines
  - Systems Engineering (SE)
  - Software Engineering (SW)
  - Integrated Product and Process Development (IPPD)
  - Supplier Sourcing (SS)

- Two Representations
  - Continuous
  - Staged

- A representation allows an organization to pursue different improvement paths
  - The organization and presentation of the data are different in each representation
  - However, the content is the same
CMMI Models
CMMI Model Components
CMMI Model Components: Process Areas

- A process area is a cluster of related practices in an area that, when performed collectively, satisfy a set of goals considered important for making significant improvement in that area.

- All CMMI process areas are common to both continuous and staged representations.
  - In the continuous representation, process areas are organized by process area categories.
CMMI Model Components: Process Areas

- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Organizational Process Performance
- Organizational Innovation and Deployment

- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Integrated Project Management
- Risk Management
- Integrated Teaming
- Integrated Supplier Management
- Quantitative Project Management

- Requirements Management
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation

- Configuration Management
- Process and Product Quality Assurance
- Measurement and Analysis
- Decision Analysis and Resolution
- Organizational Environment for Integration
- Causal Analysis and Resolution
CMMI Model Components: Generic Goals and Generic Practices

☐ Generic goals and generic practices apply to multiple process areas
  ▪ The generic goals and generic practices define a sequence of capability levels that represent improvements in the implementation and effectiveness of all the processes you choose to improve
CMMI Model Components:
Specific Goals and Specific Practices

- Specific goals apply to a process area and address the unique characteristics that describe what must be implemented to satisfy the process area
  - Specific goals are required by model components and are used in appraisals to help determine whether a process area is satisfied

- A specific practice is an activity that is considered important in achieving the associated specific goal
  - The specific practices describe the activities expected to result in achievement of the specific goals of a process area
  - Every specific practice is associated with a capability level
  - Specific practices are expected model components
CMMI Model Components: Typical Work Products and Subpractices

- Typical work products are an informative model component that provides example outputs from a specific or generic practice
  - These examples are called “typical work products” because there are often other work products that are just as effective, but are not listed

- Subpractices are detailed descriptions that provide guidance for interpreting specific or generic practices
  - Subpractices may be worded as if prescriptive, but are actually an informative component in CMMI models meant only to provide ideas that may be useful for process improvement
Example: Project Planning (PP)

- **Purpose**
  - The purpose of Project Planning is to establish and maintain plans that define project activities

- **Specific Goals**
  - SG1. Establish Estimates
  - SG2. Develop a Project Plan
  - SG3. Obtain Commitment to the Plan

- **Generic Goals**
  - GG1. Achieve Specific Goals
  - GG2. Institutionalize a Managed Process
  - GG3. Institutionalize a Defined Process
  - GG4. Institutionalize a Quantitatively Managed Process
  - GG5. Institutionalize an Optimizing Process
Example: Project Planning (PP)

- Practice-to-Goal Relationship Table

<table>
<thead>
<tr>
<th>SG 1 Establish Estimates [PA163.G102]</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 1.1-1 Estimate the Scope of the Project</td>
</tr>
<tr>
<td>SP 1.2-1 Establish Estimates of Work Product and Task Attributes</td>
</tr>
<tr>
<td>SP 1.3-1 Define Project Life Cycle</td>
</tr>
<tr>
<td>SP 1.4-1 Determine Estimates of Effort and Cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SG 2 Develop a Project Plan [PA163.G102]</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 2.1-1 Establish the Budget and Schedule</td>
</tr>
<tr>
<td>SP 2.2-1 Identify Project Risks</td>
</tr>
<tr>
<td>SP 2.3-1 Plan for Data Management</td>
</tr>
<tr>
<td>SP 2.4-1 Plan for Project Resources</td>
</tr>
<tr>
<td>SP 2.5-1 Plan for Needed Knowledge and Skills</td>
</tr>
<tr>
<td>SP 2.6-1 Plan Stakeholder Involvement</td>
</tr>
<tr>
<td>SP 2.7-1 Establish the Project Plan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SG 3 Obtain Commitment to the Plan [PA163.G102]</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP 3.1-1 Review Plans that Affect the Project</td>
</tr>
<tr>
<td>SP 3.2-1 Reconcile Work and Resource Levels</td>
</tr>
<tr>
<td>SP 3.3-1 Obtain Plan Commitment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GG 1 Achieve Specific Goals [CL102.G101]</th>
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<tbody>
<tr>
<td>GP 1.1 Perform Base Practices</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>GG 2 Institutionalize a Managed Process [CL103.G101]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP 2.1 Establish an Organizational Policy</td>
</tr>
<tr>
<td>GP 2.2 Plan the Process</td>
</tr>
<tr>
<td>GP 2.3 Provide Resources</td>
</tr>
<tr>
<td>GP 2.4 Assign Responsibility</td>
</tr>
<tr>
<td>GP 2.5 Train People</td>
</tr>
<tr>
<td>GP 2.6 Manage Configurations</td>
</tr>
<tr>
<td>GP 2.7 Identify and Involve Relevant Stakeholders</td>
</tr>
<tr>
<td>GP 2.8 Monitor and Control the Process</td>
</tr>
<tr>
<td>GP 2.9 Objectively Evaluate Adherence</td>
</tr>
<tr>
<td>GP 2.10 Review Status with Higher Level Management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GG 3 Institutionalize a Defined Process [CL104.G101]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP 3.1 Establish a Defined Process</td>
</tr>
<tr>
<td>GP 3.2 Collect Improvement Information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GG 4 Institutionalize a Quantitatively Managed Process [CL105.G101]</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP 4.1 Establish Quantitative Objectives for the Process</td>
</tr>
<tr>
<td>GP 4.2 Stabilize Subprocess Performance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GG 5 Institutionalize an Optimizing Process [CL106.G101]</th>
</tr>
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<tbody>
<tr>
<td>GP 5.1 Ensure Continuous Process Improvement</td>
</tr>
<tr>
<td>GP 5.2 Correct Root Causes of Problems</td>
</tr>
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Example: Project Planning (PP)

- SP 1.1-1 Estimate the Scope of the Project

- Typical Work Products
  - Task descriptions
  - Work package descriptions

- Subpractices

1. Develop a WBS based on the product architecture. [PA163.IG101.SP101.SubP101]

   The WBS provides a scheme for organizing the project’s work around the products that the work supports. The WBS should permit the identification of the following items: [PA163.IG101.SP101.SubP101.N/11]
   - Identified risks and their mitigation tasks
   - Tasks for deliverables and supporting activities
   - Tasks for skill and knowledge acquisition
   - Tasks for development of needed support plans, such as configuration management, quality assurance, and verification plans
   - Tasks for integration and management of non-developmental items

2. Identify the work packages in sufficient detail to specify estimates of project tasks, responsibilities, and schedule. [PA163.IG101.SP101.SubP102]

   The top-level WBS is intended to help in gauging the project work effort in terms of tasks and organizational roles and responsibilities. The amount of detail in the WBS at this more detailed level helps in developing realistic schedules, thereby minimizing the need for management reserve. [PA163.IG101.SP101.SubP102.N/01]

3. Identify work products (or components of work products) that will be externally acquired. [PA163.IG101.SP101.SubP103]
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Continuous View of CMMI

- Allows you to select the order of improvement that best meets your organization’s business objectives and mitigates your organization’s areas of risk.

- Enables comparisons across and among organizations on a process-area-by-process-area basis.
Capability Levels

- A capability level is a well-defined evolutionary plateau describing the organization’s capability relative to a particular process area.

- There are six capability levels:
  - Each level is a layer in the foundation for continuous process improvement.

- Capability levels are cumulative (i.e., a higher capability level includes the attributes of the lower levels).
Capability Levels

- 5 Optimizing
- 4 Quantitatively Managed
- 3 Defined
- 2 Managed
- 1 Performed
- 0 Incomplete
Representing Capability Levels for Individual Process Areas

- REQM: Requirements Management
- PP: Project Planning
- PMC: Project Monitoring and Control
- SAM: Supplier Agreement Management
- MA: Measurement and Analysis
- PPQA: Process and Product Quality Assurance
- CM: Configuration Management
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Staged View of CMMI

- Maturity Level 2: 7 Process Areas
  - Requirements Management
  - Project Planning
  - Project Monitoring and Control
  - Supplier Agreement Management
  - Measurement and Analysis
  - Process and Product Quality Assurance
  - Configuration Management

- Maturity Level 3: 14 Process Areas
  - Organizational Training
  - Integrated Project Management
  - Risk Management
  - Integrated Teaming
  - Integrated Supplier Management
  - Decision Analysis and Resolution
  - Organizational Environment for Integration

- Maturity Level 4: 2 Process Areas
  - Organizational Process Performance
  - Quantitative Project Management

- Maturity Level 5: 2 Process Areas
  - Organizational Innovation and Deployment
  - Causal Analysis and Resolution
Staged View of CMMI

- Provides a proven sequence of improvements, each serving as a foundation for the next

- Provides a single rating that summarizes appraisal results and permits comparisons across and among organizations
Maturity Levels

- A maturity level is a well-defined evolutionary plateau of process improvement

- There are five maturity levels

- Each level is a layer in the foundation for continuous process improvement using a proven sequence of improvements, beginning with basic management practices and progressing through a predefined and proven path of successive levels
Maturity Levels

1. Initial
   - Process unpredictable, poorly controlled, and reactive

2. Managed
   - Process characterized for projects and is often reactive

3. Defined
   - Process characterized for the organization and is proactive

4. Quantitatively Managed
   - Process measured and controlled

5. Optimizing
   - Focus on continuous process improvement
Maturity Level 1: Initial

- At maturity level 1, processes are usually ad hoc and chaotic
  - The organization usually does not provide a stable environment
  - Success in these organizations depends on the competence and heroics of the people in the organization and not on the use of proven processes

- Maturity level 1 organizations often produce products and services that work; however, they frequently exceed the budget and schedule of their projects

- Maturity level 1 organizations are characterized by a tendency to over commit, abandon processes in the time of crisis, and not be able to repeat their past successes
Maturity Level 2: Managed

☒ The process discipline reflected by maturity level 2 helps to ensure that existing practices are retained during times of stress
  ▪ When these practices are in place, projects are performed and managed according to their documented plans

☒ At maturity level 2, requirements, processes, work products, and services are managed
  ▪ The status of the work products and the delivery of services are visible to management at defined points

☒ Commitments are established among relevant stakeholders and are revised as needed
  ▪ Work products are reviewed with stakeholders and are controlled
  ▪ The work products and services satisfy their specified requirements, standards, and objectives
Maturity Level 3: Defined

- A critical distinction between maturity level 2 and maturity level 3 is the scope of standards, process descriptions, and procedures
  - At maturity level 2, the standards, process descriptions, and procedures may be quite different in each specific instance of the process (for example, on a particular project)
  - At maturity level 3, the standards, process descriptions, and procedures for a project are tailored from the organization's set of standard processes to suit a particular project or organizational unit
  - As a result, the processes that are performed across the organization are consistent except for the differences allowed by the tailoring guidelines

- Another critical distinction is that at maturity level 3, processes are typically described in more detail and more rigorously than at maturity level 2
  - At maturity level 3, processes are managed more proactively using an understanding of the interrelationships of the process activities and detailed measures of the process, its work products, and its services
Maturity Level 4: Quantitatively Managed

- Quantitative objectives for quality and process performance are established and used as criteria in managing processes
  - Quantitative objectives are based on the needs of the customer, end users, organization, and process implementers
  - Quality and process performance are understood in statistical terms and are managed throughout the life of the processes
  - Special causes of process variation are identified and, where appropriate, the sources of special causes are corrected to prevent future occurrences
  - Quality and process performance measures are incorporated into the organization’s measurement repository to support fact-based decision making in the future.

- A critical distinction between maturity level 3 and maturity level 4 is the predictability of process performance
Maturity Level 5: Optimizing

- Quantitative process-improvement objectives for the organization are established, continually revised to reflect changing business objectives, and used as criteria in managing process improvement.

- Optimizing processes that are agile and innovative depends on the participation of an empowered workforce aligned with the business values and objectives of the organization.
  - Improvement of the processes is inherently part of everybody's role, resulting in a cycle of continual improvement.

- A critical distinction between maturity level 4 and maturity level 5 is the type of process variation addressed:
  - At maturity level 4, processes are concerned with addressing special causes of process variation and providing statistical predictability of the results.
  - Though processes may produce predictable results, the results may be insufficient to achieve the established objectives.
  - At maturity level 5, processes are concerned with addressing common causes of process variation and changing the process (that is, shifting the mean of the process performance) to improve process performance (while maintaining statistical predictability) to achieve the established quantitative process-improvement objectives.
Maturity Levels Should Not Be Skipped

☐ Each maturity level provides a necessary foundation for effective implementation of processes at the next level
  ▪ Higher level processes have less chance of success without the discipline provided by lower levels
  ▪ The effect of innovation can be obscured in a noisy process

☐ Higher maturity level processes may be performed by organizations at lower maturity levels, with the risk of not being consistently applied in a crisis
Maturity Levels

Maturity Levels by Reporting Organizations (9/28/04)
Maturity Levels

Categories of Reporting Organizations (9/28/04)

- Commercial/In-house
  - 2004: 59.0%
  - 2003: 47.3%

- Contractor for Military/Government
  - 2004: 34.5%
  - 2003: 45.1%

- Military/Government Agency
  - 2004: 6.5%
  - 2003: 7.7%