MAXIMIZE THE BUSINESS VALUE OF SOFTWARE

CMMI Model and the Requirements, Evaluation Criteria and Recommendations

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Borland®
Objectives

What is CMMI

Why CMMI

Understanding CMMI

Requirements Management and Development

Recommendations

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Borland’s CMMI Advantage

Through its acquisition of TeraQuest, Borland has more CMMI experience than any other company. Our team includes:

Largest Team of CMMI Lead Appraisers in the World

- 90% of companies offering CMMI appraisals have fewer than 4 appraisers on staff; **Borland has 15.**
- Why is this important?
  - CMMI Interpretation varies with appraiser experience. We agree on common interpretations, that
    - Minimize variation for our global clients, and
    - Provide practical, non-academic guidance
  - New scenarios and questions are submitted to our appraiser community to get broad perspectives
  - Reduced risk to your improvement goals
    - No dependence on a single appraiser’s schedule or background (e.g., defense only)
    - Critical mass necessary to evolve our practice as the software industry does
  - Global presence – appraisers in multiple countries and regions

Process Consultants with an average 22+ years of software experience

Industry Thought Leaders

- SW-CMM/CMMI Co-authors (Dr. Bill Curtis, Charlie Weber)
- *Interpreting the CMMI: A Process Improvement Approach* Co-author (Kent Johnson)
- *Practical Software Measurement: Objective Information for Decision Makers* (Beth Layman)
What is it?

CMMI provides a framework for organizations improving their processes

- collection of best practices to guide process evolution
- organization change management support
- basis for benchmarking performance

CMMI provides a proven approach for delivering improvements in

- productivity
- quality
- schedule accuracy
- cost performance
What Is CMMI – Conceptual Foundations

Characteristics of CMMI

- Guidelines for improvement – not a prescriptive method
- Indicates the what’s, not the how’s
- A benchmark for improvement progress
- Not just another process standard, but a unique model of organizational development

System Development
- context and objectives
- best practices

Total Quality Management
- quantitative management
- continuous improvement

Organizational Change and Development
- culture & maturity
- change management
Why is this important in our market?

Increasing demand from the business to improve performance (IT)
- Cost, Productivity, Quality, Time to Market, Risk

Outsourcing requirement that Service Providers must be at least CMMI Level 3 to be on short lists

Organizations that outsource should at least be CMMI Level 2 to be on equal footing with Service Providers

Industry Sector demand that its suppliers must be CMMI compliant
- Defense Sector, Pharmaceuticals, Telcos

Emerging nations seeking to have similar successes as India
- Russia, Poland, China
What Is CMMI – Two Representations

Staged

Focuses on transforming an organization through a series of evolutionary stages by implementing new process areas at each maturity level

Continuous

Focuses on improving one or more process areas by implementing more sophisticated techniques for managing and performing the process at each capability level

Most organizations use the staged representation

Borland’s Software Delivery Optimization practice most frequently employs the staged model when implementing improvement programs
What Is CMMI – Staged Model

| Level 2 – Managed                      | Requirements Management  |
|                                      | Project Planning         |
|                                      | Project Monitoring and Control |
|                                      | Measurement and Analysis |
|                                      | Supplier Agreement Management |
|                                      | Configuration Management |
|                                      | Process & Product Quality Assurance |
| Level 3 – Defined                    | Requirements Development |
|                                      | Technical Solution       |
|                                      | Product Integration      |
|                                      | Verification             |
|                                      | Validation               |
|                                      | Organizational Process Focus |
|                                      | Organizational Process Definition |
|                                      | Organizational Training  |
|                                      | Integrated Project Management for IPPD |
|                                      | Risk Management          |
|                                      | Integrated Teaming       |
|                                      | Decision Analysis & Resolution |
|                                      | Organizational Environment for Integration |
| Level 4 – Quantitatively Managed     | Causal Analysis & Resolution |
|                                      | Organizational Innovation & Deployment |
| Level 5 – Optimizing                 | Organizational Process Performance |
|                                      | Quantitative Project Performance |

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Structure of CMMI Staged Maturity Levels

- Process Area 1
- Process Area 2
- Process Area n

Specific Goals

Generic Goals

Common Features

- Commitment to Perform
- Ability to Perform
- Directing Implementation
- Verifying Implementation

Specific Practices

Generic Practices

Understanding CMMI – 
Level 1 – Initial

Most Level 1 organizations do some of the practices expected at Level 2, but do not get repeatable results

Typical problems:

- Untrained project managers
- Disciplined practices sacrificed to crisis schedules
- Developers rely on personal methods (hero worship)
Understanding CMMI – Level 2 – Managed

Managed control of interfaces to the external environment

- Requirements Management
- Supplier Agreement Management
- Project Planning
- Project Monitoring and Control
- Measurement and Analysis
- Configuration Management

Managed control of the project environment

Process and Product Quality Assurance

Governance of the process
Manager characteristics:

- Balances commitments with resources
- Says ‘no’ when necessary
- Involves teams in commitments
- Plans time to repeat practices that worked in the past
- Does not sacrifice disciplined practices to schedule pressures
- Takes corrective action when progress deviates from plan
- Manages requirements changes
- Eliminates blame

Developer characteristics:

- Participates in planning
- Provides realistic estimates
- Take commitments seriously
- Experience less burnout from working nights and weekends
- Uses disciplined practices that have worked in the past
- Observes configuration management practices
- Requests advice from process and quality assurance
### Understanding CMMI – Level 3 – Defined

**Organizational support for standardized processes**
- Organizational Process Focus
- Organizational Process Definition
- Organizational Training
- Decision Analysis and Resolution
- Organizational Environment for Integration

**Engineering best practices**
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation

**Process-based project management**
- Integrated Project Management
- Integrated Risk Management
- Integrated Supplier Management
- Integrated Teaming
Understanding CMMI – Level 3 – Supporting Standard Processes

Organization’s Process Asset Repository

- Organization's standard development processes
  - Process Architecture
  - Specifications of Process Elements
  - Reqs. Analysis Process

- Guidelines for tailoring standard processes for use on projects
  - Scissors

- Database of standard project measures
  - Project 1
    - Size
    - $$$
    - Defects
    - Results
    - Lessons

- Repository of reusable project artifacts
  - Reusable history

Best practices

Lessons learned

Historical measures

Reusable history
Understanding CMMI – Level 4 – Quantitatively Managed

**Goal 1:** Manage the project quantitatively

**Goal 2:** Manage subprocess performance statistically

**Quantitative Project Management**

**Organization’s Process Performance**

- Inspection preparation times
- Inspection problem reports
- Module completion times
- System test defect reports
- Mean time to failure in test

**Organization’s Process Performance Baselines**
Predictive equation for project outcome:

\[ \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \varepsilon = \hat{Y}_{\text{outcome}} \]

Stable processes produce more accurate predictors.
Understanding CMMI – Level 5 – Optimizing

Causal Analysis and Resolution

Organizational Innovation and Deployment

Proactively improve process capability to close gaps between executive business objectives and current results
Understanding CMMI – Proactive Continuous Improvement

1. Select candidate improvements
2. Evaluate candidate improvements
3. Plan improvements
4. Do improvements
5. Act on improvements
6. Check improvements

- **Project’s defined processes**
  - Process Architecture
  - Process Elements

- **Organization’s standard processes**
  - Process Architecture
  - Process Elements

Deploy proven improvements
Requirements in the CMMI

- Gather
- Document and Analyze
- Validate
- Manage Changes
- Prioritize

Requirements Engineering
## Impact of Requirements on Projects

<table>
<thead>
<tr>
<th>Reasons Challenged</th>
<th>%</th>
<th>Reasons Canceled</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of User Involvement</td>
<td>13</td>
<td>Incomplete Requirements</td>
<td>13</td>
</tr>
<tr>
<td>Incomplete Requirements</td>
<td>12</td>
<td>Lack of User Involvement</td>
<td>12</td>
</tr>
<tr>
<td>Changing Requirements</td>
<td>12</td>
<td>Lack of Resources</td>
<td>11</td>
</tr>
<tr>
<td>Lack of Executive Support</td>
<td>8</td>
<td>Unrealistic Expectations</td>
<td>10</td>
</tr>
<tr>
<td>Technological Incompetence</td>
<td>7</td>
<td>Lack of Executive Support</td>
<td>9</td>
</tr>
<tr>
<td>Lack of Resources</td>
<td>6</td>
<td>Changing Requirements</td>
<td>9</td>
</tr>
<tr>
<td>Unrealistic Expectations</td>
<td>6</td>
<td>Lack of Planning</td>
<td>8</td>
</tr>
<tr>
<td>Unclear Objectives</td>
<td>5</td>
<td>Did not need any Longer</td>
<td>6</td>
</tr>
<tr>
<td>Unrealistic Timeframes</td>
<td>4</td>
<td>Lack of IT Management</td>
<td>6</td>
</tr>
<tr>
<td>New Technology</td>
<td>4</td>
<td>Technology Illiteracy</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>23</td>
<td>Other</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Standish Group
First, Get the Requirements Right!

Distribution of Defects

<table>
<thead>
<tr>
<th>Source: James Martin</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Requirements</strong> 56%</td>
</tr>
<tr>
<td><strong>Code</strong> 7%</td>
</tr>
<tr>
<td><strong>Other</strong> 10%</td>
</tr>
<tr>
<td><strong>Design</strong> 27%</td>
</tr>
</tbody>
</table>

Distribution of Effort to Repair Defects

<table>
<thead>
<tr>
<th>Source: Dean Leffingwell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Requirements</strong> 82%</td>
</tr>
<tr>
<td><strong>Code</strong> 1%</td>
</tr>
<tr>
<td><strong>Other</strong> 4%</td>
</tr>
<tr>
<td><strong>Design</strong> 13%</td>
</tr>
</tbody>
</table>
Proven Value of Requirements Processes

Requirements Process Cost as a % of Total Project Cost

Source: Ivy Hooks — 28 NASA projects
Requirements Issues Impact Outsourcing

Reasons Why Outsourcing Did Not Meet Expectations

- Communication Breakdowns
- Inability to Measure and Monitor Performance Accurately
- Changing Customer Requirements at the Business Unit
- Unrealistic Deadlines
- No Accurate Performance Benchmarking Before Outsourcing
- Enterprise Lack of Experience With Outsourcing
- Lack of Understanding of End-User Goals
- Lack of Trust Between the Enterprise and Vendor
- Unforeseen Technical Difficulties
- Inadequate/Ineffective Contract Terms/Conditions

Notes: Multiple responses allowed
Respondents were asked to select top three reasons.
Number of respondents = 43
Source: Gartner Dataquest (June 2003)
CMMI Requirements Process Areas

Requirements Management
Goals, and Practices

SG 1 Manage Requirements
Requirements are managed, and inconsistencies with project plans and work products are identified

- SP 1.1 Obtain an Understanding of Requirements
- SP 1.2 Obtain Commitment to Requirements
- SP 1.3 Manage Requirements Changes
- SP 1.4 Maintain Bi-directional Traceability of Requirements
- SP 1.5 Identify Inconsistencies Between Project Work and Requirements

Requirements Development
Goals, and Practices

SG 1 Develop Customer Requirements
Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.

SG 2 Develop Product Requirements
Customer requirements are refined and elaborated to develop product and product component requirements.

SG 3 Analyze and Validate Requirements
The requirements are analyzed and validated, and a definition of required functionality is developed.
Requirements Management Context

- Obtain an Understanding of Requirements
- Obtain Commitment to Requirements
- Manage Requirements Changes
- Identify Inconsistencies between project work and Requirements
- Maintain Bi-Directional Traceability of Requirements

Traceability Hierarchy

Manage Requirements

Requirements
Requirements Management - 1

Purpose, Goals, and Practices

The purpose of Requirement Management is to manage the requirements of a project's product and product components and identify inconsistencies between those requirements and the project's plans and work products.

SG 1 Manage Requirements

Requirements are managed, and inconsistencies with project plans and work products are identified.

SP 1.1 Obtain an Understanding of Requirements
SP 1.2 Obtain Commitment to Requirements
SP 1.3 Manage Requirements Changes
SP 1.4 Maintain Bi-directional Traceability of Requirements
SP 1.5 Identify Inconsistencies Between Project Work and Requirements
The process is institutionalized as a managed process.

All ten GP 2.X (These Generic Practices apply to each L2 PA)

<table>
<thead>
<tr>
<th>Common Feature</th>
<th>Number</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>GP 2.1</td>
<td>Establish an Organizational Policy</td>
</tr>
<tr>
<td>AB</td>
<td>GP 2.2</td>
<td>Plan the Process</td>
</tr>
<tr>
<td>AB</td>
<td>GP 2.3</td>
<td>Provide Resources</td>
</tr>
<tr>
<td>AB</td>
<td>GP 2.4</td>
<td>Assign Responsibilities</td>
</tr>
<tr>
<td>AB</td>
<td>GP 2.5</td>
<td>Train People</td>
</tr>
<tr>
<td>DI</td>
<td>GP 2.6</td>
<td>Manage Configurations</td>
</tr>
<tr>
<td>DI</td>
<td>GP 2.7</td>
<td>Identify and Involve Relevant Stakeholders</td>
</tr>
<tr>
<td>DI</td>
<td>GP 2.8</td>
<td>Monitor and Control the Process</td>
</tr>
<tr>
<td>VE</td>
<td>GP 2.9</td>
<td>Objectively Evaluate Adherence</td>
</tr>
<tr>
<td>VE</td>
<td>GP 2.10</td>
<td>Review Status with Higher-Level Management</td>
</tr>
</tbody>
</table>
Requirements Development - Context

- Develop Customer Requirements
- Develop Product Requirements
- Analyze and Validate Requirements

Customer Requirements
Product, Product-Component, and Interface Requirements
Validated Requirements
Purpose, Goals, and Practices
The purpose of Requirements Development is to produce and analyze customer, product, and product component requirements.

SG 1 Develop Customer Requirements
Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements.

SP 1.1 Elicit Needs
SP 1.2
Purpose, Goals, and Practices - continued

SG 2 Develop Product Requirements

Customer requirements are refined and elaborated to develop product and product component requirements.

- SP 2.1 Establish Product and Product Component Requirements
- SP 2.2
- SP 2.3 Identify Interface Requirements
Purpose, Goals, and Practices - continued

SG 3 Analyze and Validate Requirements

The requirements are analyzed and validated, and a definition of required functionality is developed.

- SP 3.1 Establish Operational Concepts and Scenarios
- SP 3.2
- SP 3.3 Analyze Requirements
- SP 3.4 Analyze Requirements to Achieve Balance
- SP 3.5 Validate Requirements with Comprehensive Methods
Purpose, Goals, and Practices - continued

GG 3 Institutionalize a Defined Process

In addition to the 10 Generic Practices in Level 2, at Level 3 two more Generic Practices are required for a total of 12 Generic Practices. Those two additional practices are as follows:

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<tr>
<td>CO</td>
<td>GP 3.1</td>
<td>Establish a Defined Process</td>
</tr>
<tr>
<td>DI</td>
<td>GP 3.2</td>
<td>Collect Improvement Information</td>
</tr>
</tbody>
</table>
Recommendations

Executive workshops

Process appraisals

Improvement planning

Mentoring

Benefits Analysis

Initiate

Diagnose

Plan

Implement

Evaluate

Risk analyses

Training

Measurement
How can we help you?

Role of Executive in the improvement program
- Sponsorship
- Commitment
- Change Management

- Base line of Requirements Management
- Prioritize and Action Planning
- Improvement Support
  - directing, reviewing, coaching
  - Skills Transfer

- Implementation/Deployment Support
  - Coaching, Mentoring
  - Change Management
  - Tool Support

BORLAND PROCESS OPTIMIZATION
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