

CMMI® and Process Improvement (Capability Maturity Model Integration)

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Topics

- CMMI process quality premise
- Terminology: process, process improvement & quality
- CMMI – what is it, tangible evidence of effectiveness, who uses it ?
- CMMI – major components & how does it work ?
- Implementation - how to begin
- Summary

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CMMI Process Quality Premise - 1

“The quality of a product is largely determined by the quality of the process that is used to develop and maintain it.”

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CMMI Process Quality Premise - 2

Systematic process improvement shown to provide

- Less process variability, greater predictability of cost, schedule & performance
- Increased consistency of processes across projects throughout the organization
- Increased product and service quality & consistency in meeting requirements
- Decreased costs
 - Reduction in rework - one of biggest cost factors. Studies indicate rework may be as high as 50% - 60% of project costs
 - Reduction in non-value-added work

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Terminology: Process, Process Improvement & Quality

Process is a **set of practices** performed to achieve a given purpose; it may include tools, methods, materials, and/or people

Process improvement is the identification, examination, and reengineering of the critical processes we use

Quality is the ability of a set of coherent characteristics of a product, product component, or process to fulfill requirements of customers

sample characteristics of quality and process performance

functionality	reliability	maintainability	usability
duration	predictability	timeliness	accuracy

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What is CMMI ? - 1

Process improvement model for organizations who want to improve processes focused on the development, acquisition, and/or maintenance of products and services

- Developed by the Software Engineering Institute (SEI) at Carnegie Mellon University
- Integrates proven standards and models (e.g., IEEE, ISO)
- Provides a set of proven, industry-recognized (world-wide) practices that address productivity, performance, costs and stakeholder satisfaction
- Provides a comprehensive framework, roadmap to organize, prioritize and implement process improvement activities
- Describes an evolutionary path for improvement from ad hoc, "immature processes" to disciplined, "mature processes" with improved quality and effectiveness

What is CMMI ? - 2

- CMMI is a structured collection of elements that include
 - The **processes** that are **proven** to be essential for mature organizations to be practicing
 - For each of the processes, CMMI identifies the **best practices** that should be implemented
- Model may be used as the framework for process improvement throughout the organization
 - Provide a big picture of all the process areas and how they interact
 - Help set the overall process improvement objectives and priorities
 - Identify process areas and implement **best practices** for process
 - Appraise (assess) organizational **maturity** and process area **capability** and have ability to make baseline comparisons within and across organizations

Tangible Evidence – CMMI Performance Measures

The performance results are from 30 different organizations that have adopted CMMI. Improvements are shown as percentage change in one or more of the six categories of performance measures below.

Performance Category	Median Improvement
Cost	34%
Schedule	50%
Productivity	61%
Quality	48%
Customer Satisfaction	14%
Return on Investment	4:1

August 2006 SEI technical report, *Performance Results of CMMI-Based Process Improvement (CMU/SEI-2006-TR-004)*

Web site at <http://www.sei.cmu.edu/cmmi/results.html>.

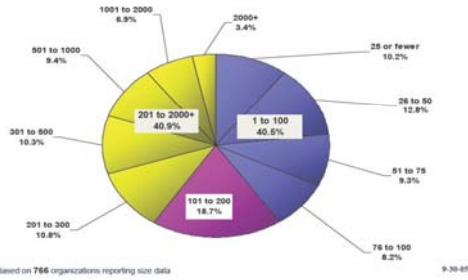
Who is using it ? - 1

Thousands of organizations world-wide including

- | | | |
|------------------------------|------------------|------------------|
| • Bank of America | BMW | Boeing |
| • Borland | Bosch | EDS |
| • FAA | Fujitsu | General Dynamics |
| • General Motors | Hewlett Packard | Hitachi |
| • Honeywell | IBM | Infosys |
| • Int'l Atomic Energy Agency | Intel | Lockheed Martin |
| • Lucent Technologies | Microsoft | MITRE Corp |
| • Mitsubishi | Motorola | NASA |
| • NCR | Northrop Grumman | Oracle |
| • Raytheon | SAIC | Samsung |
| • Sony | TRW | Xerox |
| • U.S. Air Force | U.S. Army | U.S. Navy |

Who is using it ? - 2

Organizations using CMMI vary in size



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How Does CMMI Work – Major Components - 1

- CMMI shows what to do, describing the major processes an organization must have in-place based on industry best practices - Emphasis is on measurement and reducing variation within processes
 - Fundamental CMMI components - well-defined set of **22 process areas (PAs)** that describe the characteristics of effective processes
 - Each **process area** is a cluster of related practices performed collectively to achieve a set of goal

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How Does CMMI Work – Major Components - 2

- Each **process area** consists of **specific goals and practices** proven by experience to be effective in guiding the improvement of project and organizational processes
 - Specific Goals (SGs)
 - Address the unique characteristics that describe what must be implemented to satisfy the process area
 - Specific Practices (SPs) for each goal
 - Activities that result in the achievement of the Specific Goals

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How Does CMMI Work – Major Components - 3

- Each **process area** also has **generic goals and practices** that help “institutionalize” process improvement across the organization to insure the processes are consistent and repeatable
- To “institutionalize process improvement” means the organization has a supporting infrastructure and corporate culture that
 - Reinforces the mature methods, practices, and procedures achieved by fully implementing the “specific goals and practices” so that they become the way of doing business throughout the organization, even after those who originally defined them are gone. *“The process is ingrained in the way we do things around here”*.

How Does CMMI Work – Major Components - 4

Institutionalized process improvement is characterized by...

- Visible, continuous top-level sponsorship with committed, dedicated resources and support
- CMMI and process improvement is well understood and integrated vertically and horizontally throughout the organization
- Commitment to long-term continuous improvement

How Does CMMI Work – 2 Representations

CMMI has two **ways** (“representations”) of **organizing & working** on the process areas

- “**Continuous**” and “**Staged**” representations
 - Both use the same 22 process areas – providing essentially the same content but in a different way

How Does CMMI Work – Continuous Representation

Continuous Representation

- The 22 process areas are grouped by four categories
- **Organization may choose to improve the performance of a single process-related trouble spot, or work on several process areas that are closely aligned to its business objectives**
- The term “**capability levels**” used to describe improvement in individual process areas

Process Area Categories	CMMI Process Areas
Project Management	Project Planning Project Monitoring and Control Supplier Agreement Management Integrated Project Management Risk Management Quantitative Project Management
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Decision Analysis and Resolution Causal Analysis and Resolution
Process Management	Organizational Process Focus Organizational Process Definition Organizational Training Organizational Process Performance Organizational Innovation and Deployment

How Does CMMI Work – Staged Representation

Staged Representation

- The 22 process areas are grouped or organized by maturity levels
- Organization works on successive maturity levels for pre-defined groups of process areas
- The term "maturity levels" used to describe improvement in this representation

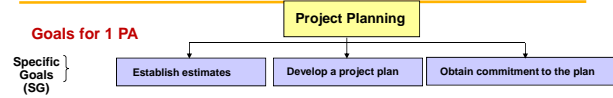
Level	CMMI Process Areas
5 Optimizing	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	Organizational Process Performance Quantitative Project Management
3 Defined	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution
2 Managed	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Initial	Processes are ad hoc, improvised, inconsistent

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How Does CMMI Work – A Process Example

Goals for 1 PA



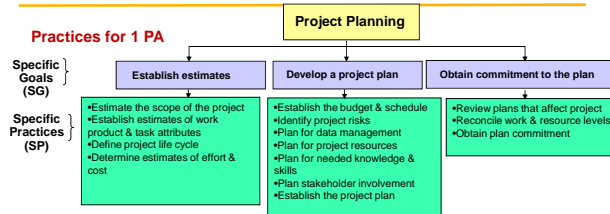
Specific Goals (SG)

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How Does CMMI Work – A Process Example

Practices for 1 PA

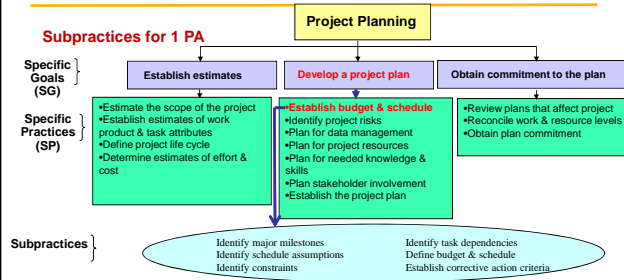


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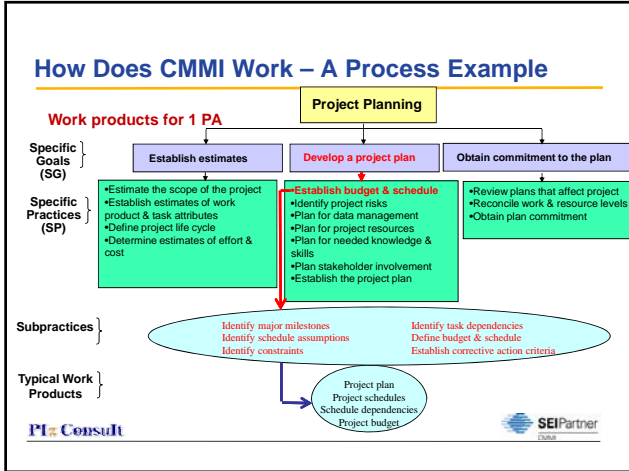
How Does CMMI Work – A Process Example

Subpractices for 1 PA



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How Does CMMI Work – Immature Processes

Characteristics of CMMI immature (low maturity, low capability) processes

- Processes are ad hoc and improvised (may be characterized by an attitude that change is not necessary)
- Process descriptions are not rigorously followed or enforced
- Performance is highly dependent on current practitioners
- Understanding of the current status of a project is limited
- Immature processes result in being reactive and fighting fires
 - No time to improve - constantly reacting
 - Firefighters get burned
 - Embers may rekindle later

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How Does CMMI Work – Mature Processes

Characteristics of CMMI mature (high maturity, high capability) processes

- Processes are defined, documented, and continuously improved
- Process descriptions are consistent with the way work actually gets done
- Processes are well controlled - process variability is identified and reduced
- Processes are supported visibly by everyone - attitude of embracing change
- Constructive use of process measurement

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How Does CMMI Work – Maturity Levels

No consistent emphasis on process

- Processes usually ad hoc
- Success dependent on competence & heroics of the people and not on use of proven processes
- Process activities inconsistent, unable to repeat good practices, processes abandoned in time of crisis
- Requirements often misunderstood, uncontrolled
- Schedules and budgets frequently missed
- No supporting infrastructure to support repeatability, consistency of processes
- Progress not measured
- Tendency to over-commit

"I've been just fine doing it my way. Processes limit my creativity"

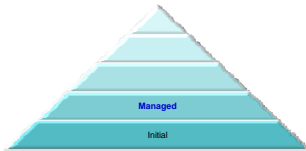
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How Does CMMI Work – Maturity Levels

Emphasis on process at project level

- Focus on project management
- Requirements clarified and managed
- Project plan established & maintained
- Projects performed and managed according to documented plans
- Commitments among project stakeholders established
- Progress monitored (tracked) & controlled
- Independent quality assurance of adherence to processes
- Project work products controlled

"At first, the paperwork does takes a little time but it helps me manage everything that's important for my project"



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How Does CMMI Work – Maturity Levels

Emphasis on developing "standard processes" across the organization

- Develop and use organizational standards, procedures, tools and methods
- Standard processes are consistently used and improved over time
- To meet unique needs, projects establish "defined processes", tailoring the standard processes according to approved tailoring guidelines
- Defined processes clearly state purpose, inputs, entry and exit criteria, activities, roles, measures, verification steps, outputs

"Our project's effectiveness has increased by permitting us to tailor standard processes"



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How Does CMMI Work – Maturity Levels

Emphasis on quantitatively managing projects and organizational performance

- Organization and projects establish quantitative objectives for quality and process performance
- Quantitative objectives for quality and process performance used to manage the project's processes and sub-processes
- Performance of processes is predictable and controlled using statistical and other quantitative techniques – unique (special) causes of process variation are identified and corrected

"Quantifying allows us to see where we are progressing and where we are falling behind"



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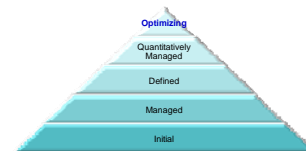
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How Does CMMI Work – Maturity Levels

Emphasis on removing common causes of process variation, and on deploying continuous improvement across the organization

- Causes of defects identified, analyzed and controlled
- Identify and deploy new tools and process improvements to meet needs and business objectives

"We are now able to make drastic improvements and get them implemented across the organization in no time at all"



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Topics

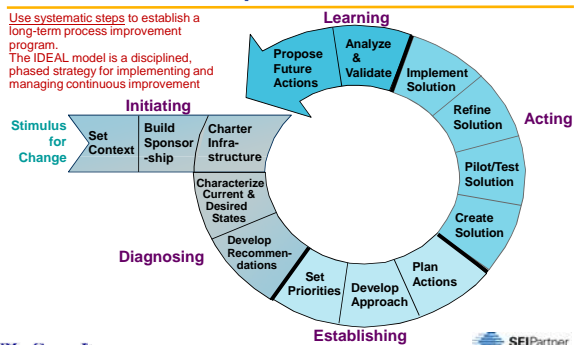
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CMMI Implementation

- 1 Become knowledgeable about CMMI
- 2 Executive/senior management sponsorship
- 3 Develop & communicate shared vision
- 4 Stakeholders define requirements, goals, priorities
- 5 Build sound infrastructure
- 6 Comprehensive implementation plan
- 7 Systematic implementation, evaluation & continuous improvement of implementation

CMMI's Model for Implementation

Use systematic steps to establish a long-term process improvement program. The IDEAL model is a disciplined, phased strategy for implementing and managing continuous improvement



Before "Initiation" Stage Train Key People in CMMI

- ["Introduction to CMMI, Version 1.2"](#)
 - Software Engineering Institute (SEI) certified course
- Introduction course will enable the participant to
 - Understand the importance of defined processes
 - Understand the rationale for process improvement
 - Comprehend the CMMI model
 - Identify ways of applying the CMMI model for process improvement
- Audience
 - Systems and software engineers
 - Systems, Program and software managers
 - Practitioners of disciplines that support systems and software



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Summary

- CMMI based on well-established, proven models
- CMMI not prescriptive
 - **Shows** "what" to do (which process areas + best practices)
 - Does not dictate "how"
 - Does not limit choice of lifecycle model
 - Does not require any specific technologies
 - Does not require that documentation conform to a particular set of standards
- Does not commit an organization to an irreversible path
- To implement, need trained, committed staff. There is nothing to purchase.

Thank You

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