

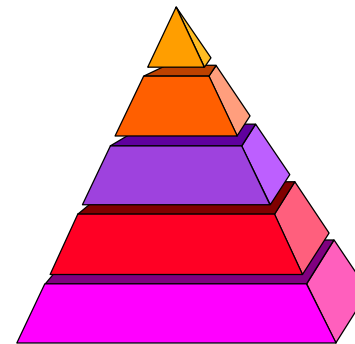


Capability Maturity Model[®] Integration (CMM[®]) Overview

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and



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Software Engineering Institute (SEISM)

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CMMI Overview

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Settling for Less

Do these statements sound familiar? If they do, your organization may be settling for less than it is capable of and may be a good candidate for process improvement.

“I'd rather have it wrong than have it late. We can always fix it later.”

- *a senior software manager (industry)*

“The bottom line is schedule. My promotions and raises are based on meeting schedule first and foremost.”

- *a program manager (government)*

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?

Software-Intensive Systems

Software is becoming a larger part of many products and services.

Systems and software disciplines traditionally have not been well integrated.

The importance of software in systems has increased dramatically.



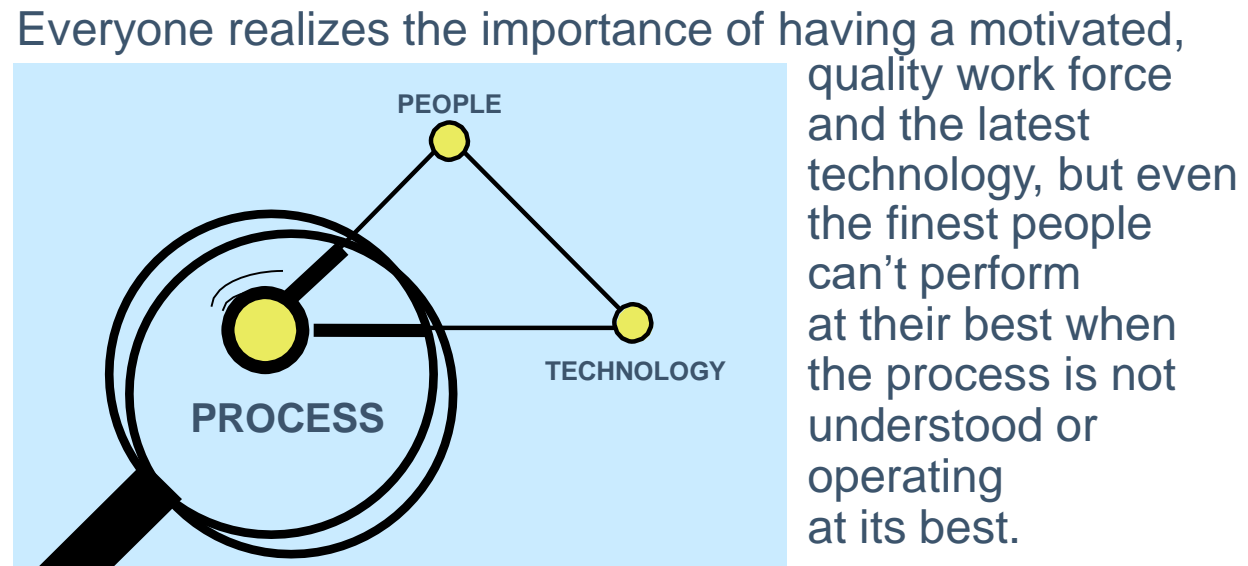
The Process Management Premise

The quality of a system is highly influenced by the quality of the process used to acquire, develop, and maintain it.

This premise implies a focus on processes as well as on products.

- This is a long-established premise in manufacturing (and is based on TQM principles as taught by Shewhart, Juran, Deming, and Humphrey).
- Belief in this premise is visible worldwide in quality movements in manufacturing and service industries (e.g., ISO standards).

The Role of Process



Maturity Models – An Overview

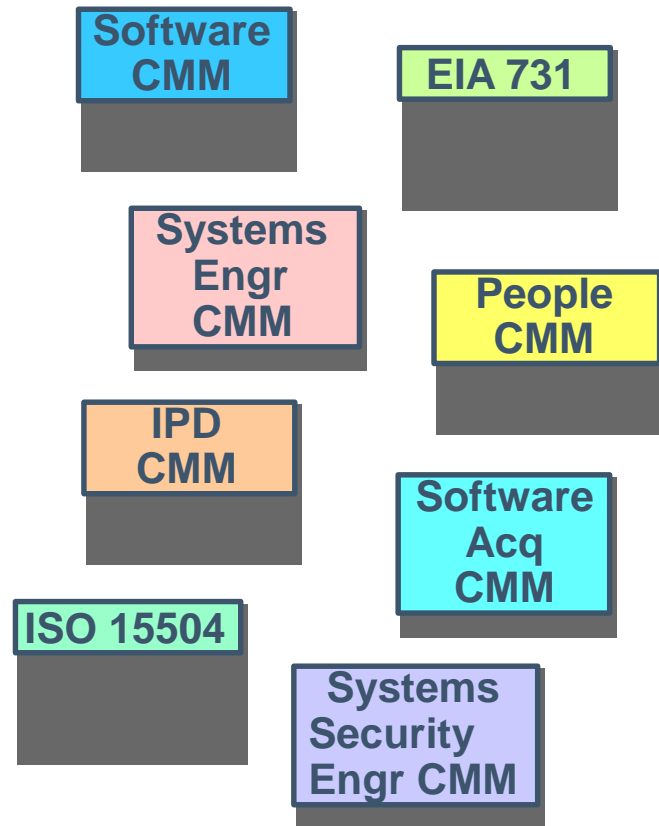
A maturity model is a structured collection of elements that describe characteristics of effective processes.

A maturity model provides

- a place to start
- the benefit of a community's prior experiences
- a common language and a shared vision
- a framework for prioritizing actions
- a way to define what *improvement* means for your organization

A maturity model can be used as a benchmark for assessing different organizations for equivalent comparison.

Multiple Process Models



Success of the Software CMM[®] caused development of other CMMs, but they

- had different structures, formats, terms, ways of measuring maturity
- caused confusion, especially when more than one was used together
- were difficult to integrate into a combined improvement program
- were difficult to use in supplier selection and sub-contracting

CMMI in a Nutshell

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

The CMMI Products

Models

Four Disciplines

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

Two Representations

- Staged
- Continuous

Modules

CMMI Acquisition Module

Appraisal Method

Appraisal Requirements for CMMI (ARC)

SCAMPI Method Definition Document (MDD)

Training

Four Courses

- Introduction to CMMI
- Intermediate Concepts of CMMI
- CMMI Instructor Training
- SCAMPI Lead Appraiser Training

CMMI Expected Business Benefits

Substantial reduction in systems integration and test time with greater probability of success

Cause integration of, and interaction among, the various engineering functions

Extend SW-CMM benefits to the total project & organization

Employ systems engineering principles in software development

Increase & improve SE content in programs

Leverage previous process improvement investments

CMMI Expected Technical Benefits

Increased focus and consistency in

- requirements development and management
- systems design and development
- systems integration
- risk management
- measurement & analysis
- other engineering-related activities

Enterprise-Wide Improvement

Organizations that want to pursue process improvement in multiple functional areas can use CMMI to do so with less additional investment for each additional function.

- CMMI enables process integration and product improvement.
- CMMI integrates multiple disciplines.
- CMMI provides a framework for integrating new disciplines as needs arise.

For detailed information about CMMI benefits, see the Performance Results Web page,

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

Real World Benefits: Lockheed Martin M&DS

SW CMM ML2 (1993) to ML 3 (1996) to CMMI ML5 (2002)

Results

- captured a greater percentage of available award fees; now receiving 55 percent more compared to the baseline that remained unrealized at SW-CMM level 2

1996 - 2002

- increased software productivity by 30%
- decreased unit software cost by 20%
- decreased defect find and fix costs by 15%

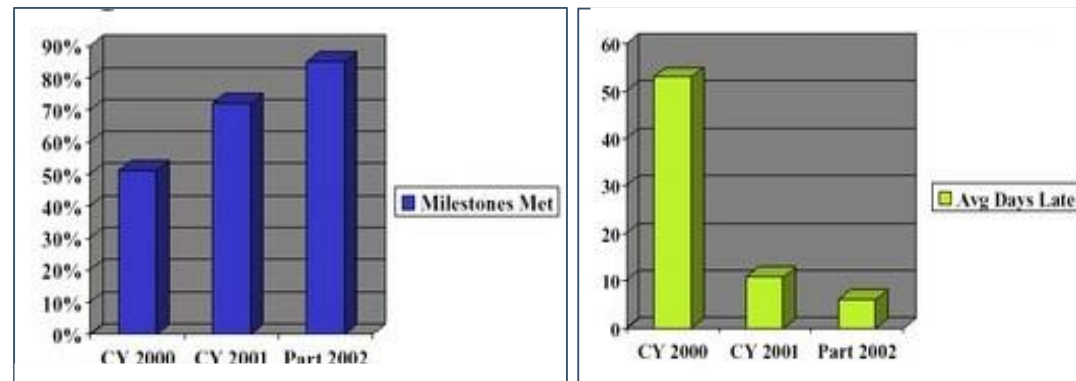
(From proprietary sources with permission; August 2003.)

Real World Benefits: General Motors Corporation

CMMI Focus 2001

Goal is Integration of Supplier Work and GM Project Execution

Results: Improved schedule—projects met milestones and were fewer days late



(From *Camping on a Seesaw: GM's IS&S Process Improvement Approach*. Hoffman, Moore & Schatz, SEPG 2003.)

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Bodies of Knowledge Captured in CMMI Models

Organizations select the bodies of knowledge most relevant to achieving their business objectives. Bodies of knowledge available in CMMI models include

- systems engineering (SE)
- software engineering (SW)
- integrated product and process development (IPPD)
- supplier sourcing (SS)

Understanding CMMI Representations

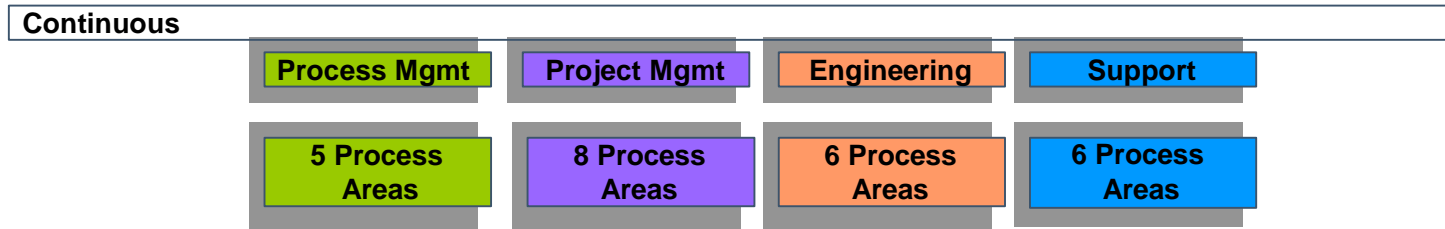
There are two types of representations in the CMMI models:

- staged
- continuous

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.

Continuous View of CMMI



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

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

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

- Configuration Management
- Process and Product Quality Assurance
- Measurement and Analysis
- Decision Analysis and Resolution
- Organizational Environment for Integration
- Causal Analysis and Resolution

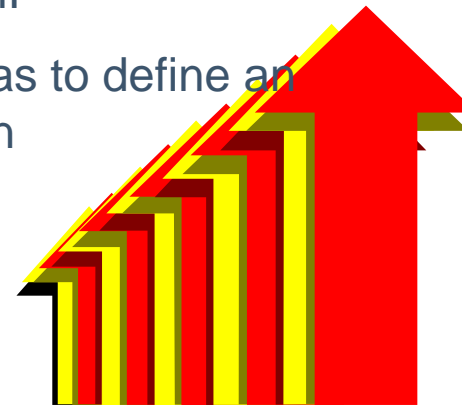
Continuous Representation

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

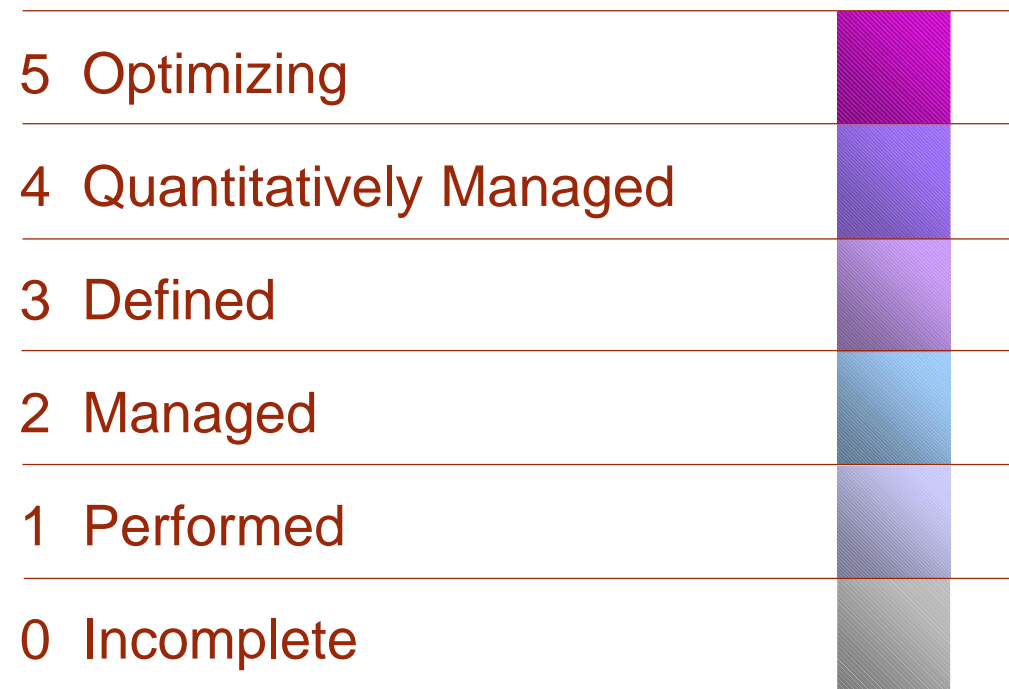
Enables comparisons across and among organizations on a process-area-by-process-area basis

Provides an easy migration from EIA 731 (and other models with a continuous representation) to CMMI

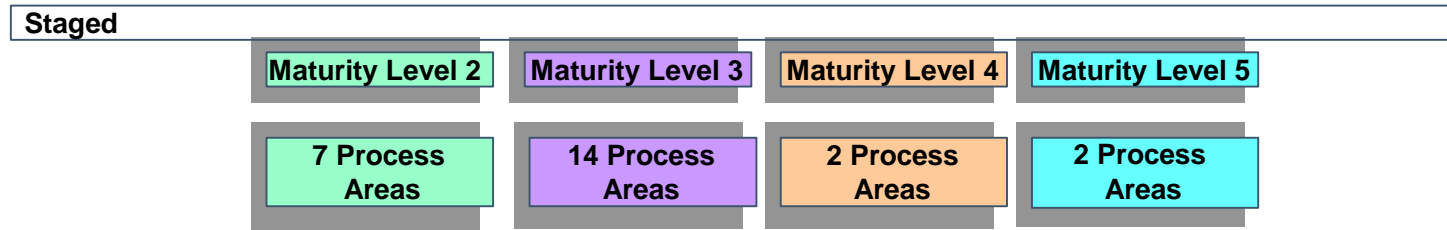
Uses predefined sets of process areas to define an improvement path for an organization



The Capability Levels



Staged View of CMMI



- Requirements Management
- Project Planning
- Project Monitoring and Control
- Supplier Agreement Management
- Measurement and Analysis
- Process and Product Quality Assurance
- Configuration Management

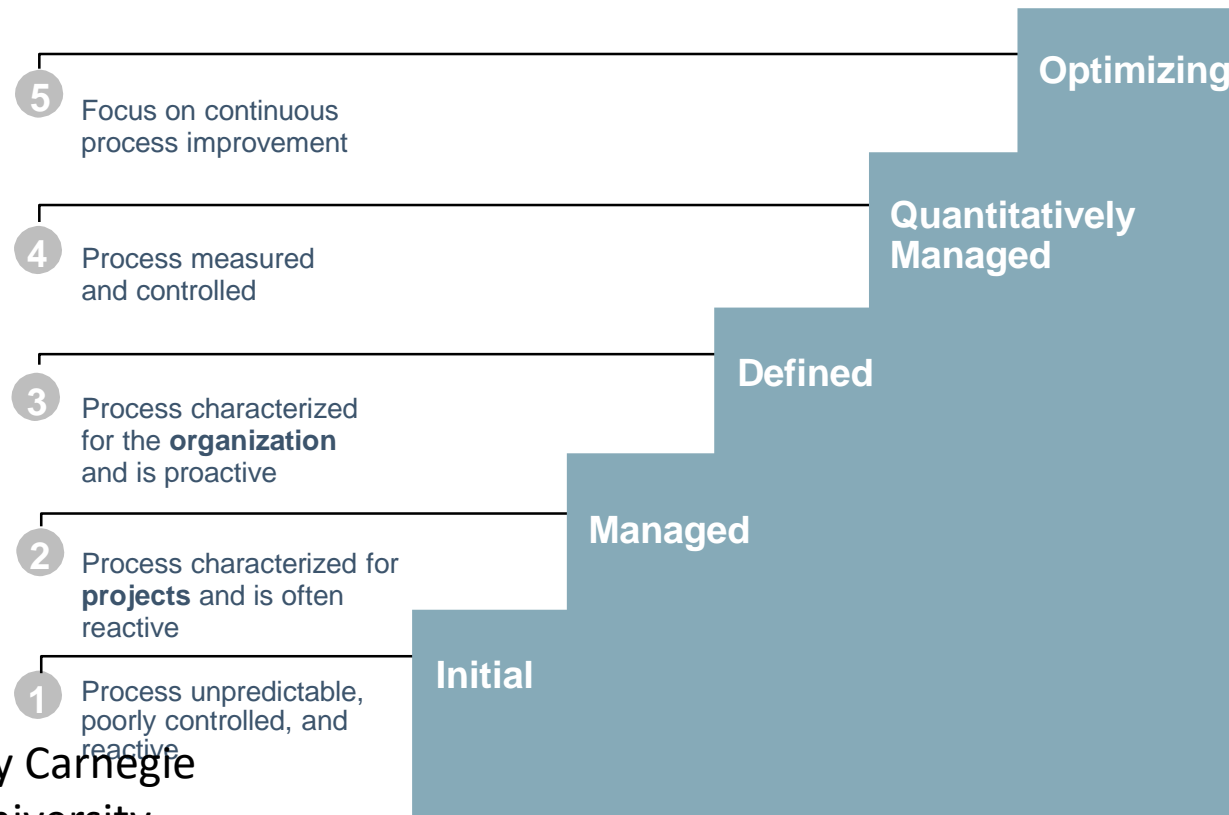
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation
- Organizational Process Focus
- Organizational Process Definition

- Organizational Training
- Integrated Project Management
- Risk Management
- Integrated Teaming
- Integrated Supplier Management
- Decision Analysis and Resolution
- Organizational Environment for Integration

- Organizational Process Performance
- Quantitative Project Management

- Organizational Innovation and Deployment
- Causal Analysis and Resolution

The Maturity Levels



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Organizations Using CMMI

Accenture

Boeing

Dyncorp

FAA

General Dynamics

Honeywell

Intel

L3 Communications

NASA

Nokia

NTT Data

Raytheon

Samsung

U.S. Air Force

U.S. Treasury Department

Bank of America

Bosch

EDS

Fannie Mae

General Motors IBM

Global Services

J. P. Morgan

Lockheed Martin

NDIA

Northrop Grumman

OUSD (AT&L)

Reuters

Social Security Administration

U.S. Army

Wipro

BMW

Ericsson

Fujitsu

Hitachi

Infosys

KPMG

Motorola

NEC

NRO

Polaris

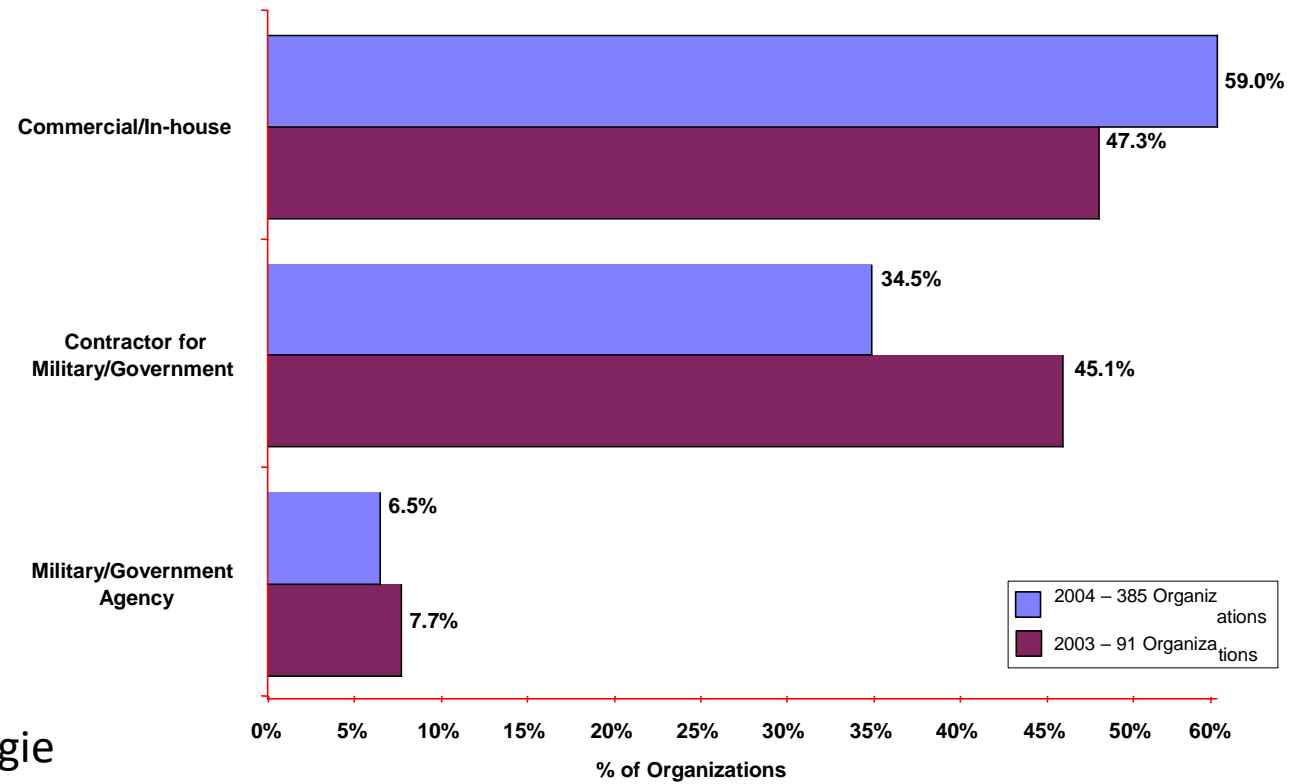
SAIC

TRW

U.S. Navy

Zurich Financial Services

Categories of Reporting Organizations (9/28/04)



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The Bottom Line

Process improvement should be done to help the business—not for its own sake.



“In God we trust,
all others bring data.”

- W. Edwards Deming

CMMI Can Benefit You

CMMI provides

- a common, integrated vision of improvement for all elements of an organization
- efficient, effective improvement and appraisal across multiple disciplines
- improvements to best practices incorporated from the Software CMM, EIA 731, IPD-CMM and others
- a means of representing new discipline-specific information in a standard, proven process-improvement context

CMMI Benefits

CMMI-based process improvement benefits include

- improved schedule and budget predictability
- improved cycle time
- increased productivity
- improved quality (as measured by defects)
- increased customer satisfaction
- improved employee morale
- increased return on investment
- decreased cost of quality

Improve Your Bottom Line

Improvement means different things to different organizations.

- What are your business goals?
- How do you measure progress?

Improvement is a long-term, strategic effort.

- What is the expected impact on the bottom line?
- How will impact be measured?

For More Information About CMMI

Go to CMMI Web site:

<http://www.sei.cmu.edu/cmmi>

<http://seir.sei.cmu.edu>

Contact SEI Customer Relations:

Customer Relations

Software Engineering Institute

Carnegie Mellon University

Pittsburgh, PA 15213-3890

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customer-relations@sei.cmu.edu

Standard CMMI® Appraisal Method for Process Improvement (SCAMPI)

Appraisal Operations Sequence

- **Standard Class A Appraisal:** One to three days of review with participation by the lead appraiser and one representative from each mini-team.
- **Shoulder-to-Shoulder Class A Appraisal:** One to three days of review with participation by the lead appraiser and one representative from each mini-team.

SCAMPI Activity / Event

- Readiness Review
- Program In-Briefing
- Appraisal On-Site Kick-off
- Artifact Review
- Affirmations
- Appraisal Team Consensus
- Preliminary Findings
- Goal Satisfaction & Ratings

Mini-Team

- Conduct Interviews
- Review objective evidence
- Identify weaknesses
- Characterize extent of implementation of practices

Team Responsibilities

- Entire team acts as a review group for mini-team work
- Consensus: Team decisions are made by consensus. All team members can support it

Artifacts

- Artifacts are a tangible form of objective evidence indicative of work being performed that represents either the primary output of a model practice or a consensus of implementing a model practice.
- Examples:
 - Work products listed in CMMI practices
 - Documents, deliverable products, training materials, meeting minutes, etc.

Affirmations

- Affirmations are an oral or written statement confirming or supporting implementation (or lack of implementation) of a model practice.
- Examples
 - Oral affirmations include Interview responses, presentations, and demonstrations
 - Written affirmations include written statements of the practice

Artifacts & Affirmations

- SCAMPI does not favor artifacts over affirmations or vice versa
- Artifacts and affirmations are treated with equal weight
- The appraisal mini-team and full team must be convinced that the practice is implemented based on the evidence
- Due to the sampling design of the appraisal, every program and support function must have at least one artifact and one affirmation for every specific and generic practice

Practice Characterization

- Fully Implemented (FI)
- Largely Implemented (LI)
- Partially Implemented (PI)
- Not Implemented (NI)

Rating Goals

- A goal is rated satisfied (S) if any only if
 - All associated practices at the organization unit level are characterized either as Fully Implemented or Largely Implemented AND the aggregation of weaknesses does not have a significant negative impact on goal achievements.
- For a goal to be rated unsatisfied (U), the team must be able to describe how the weaknesses led to this rating.

Rating of Process Areas

- Satisfied
- Unsatisfied
- Not applicable
- Not rated
- Out of scope

Maturity Level Assignment

- To achieve a maturity level:
 - All Process areas at that level and all levels below it must be satisfied or determined to be not applicable
AND
 - To achieve maturity level 3 or higher, the generic goal 3 for each applicable maturity level 2 PA must also be rated satisfactory for maturity level 3 or higher.