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State of CMMI: Improving Processes for Better Products

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Topics

Brief Background
The Integration Issue
ROI Discussions - Historical
Early Transition Evidence
CMMI as a Framework
CMMI Today
CMMI Tomorrow
SW-CMM ACAT-I Survey Results
Early Appraisal Results
Summary

What is CMMI?

CMMI integrates common elements and best features of multiple CMMs, providing:

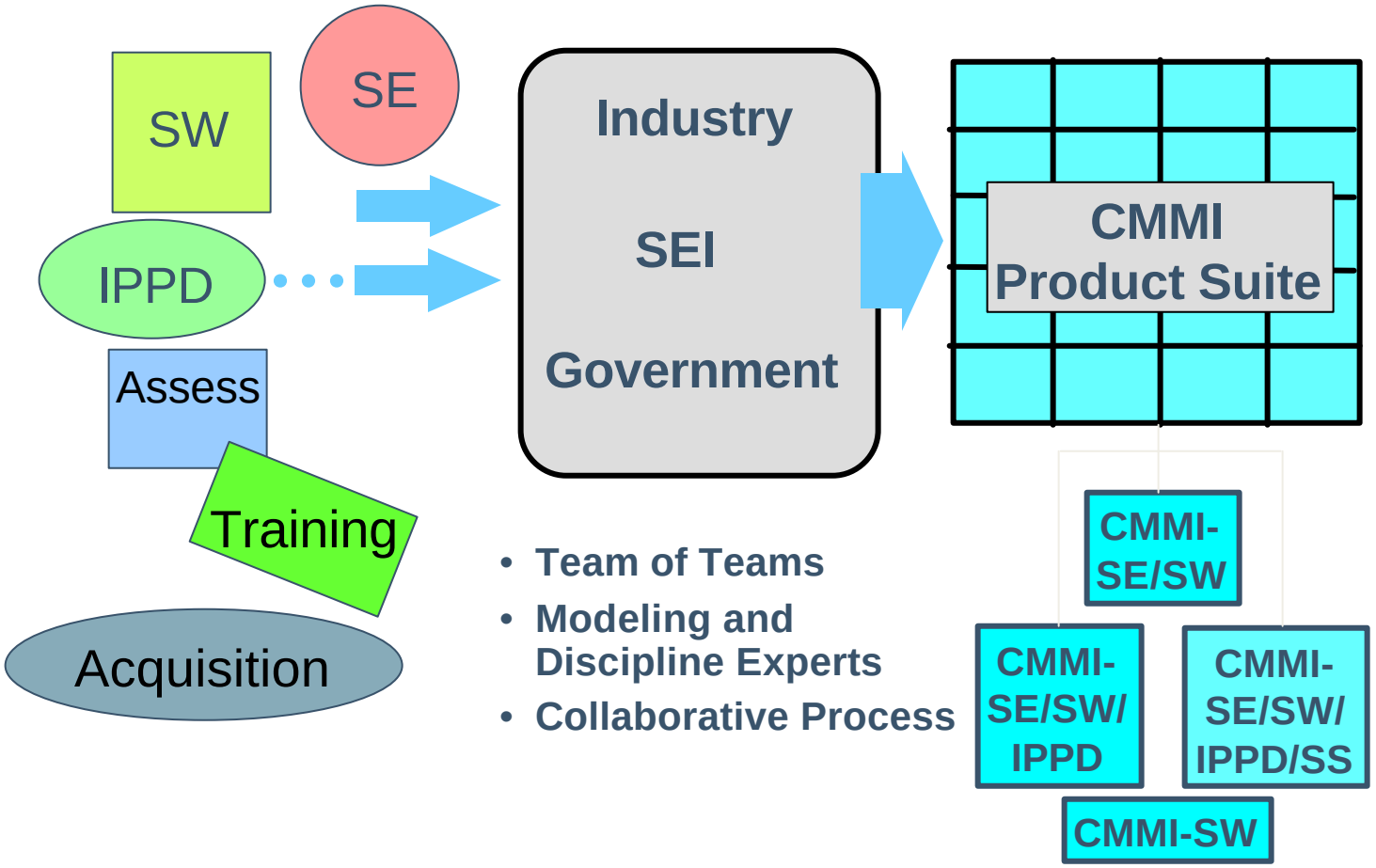
- common terminology
- common training
- an integrated appraisal method (SCAMPI*)
  - **assessment** for internal process improvement
  - **evaluation** for external (i.e., government) review

CMMI forces a functional integration of systems engineering and software engineering, and provides the basis for Integrated Product Development.

CMMI also incorporates a framework that can be extended to additional discipline areas.

*** SCAMPI[SM] = Standard CMMI Appraisal Method for Process Improvement**

The CMMI Product Line Approach



- Team of Teams
- Modeling and Discipline Experts
- Collaborative Process

CMMI Design Goals and Benefits

Design Goals:

- integrate the source models, eliminate inconsistencies, reduce duplication
- reduce the cost of implementing multi model-based process improvement
- be sensitive to impact on legacy efforts

Benefits:

- efficient, effective appraisal and improvement across multiple process disciplines
- reduced training and appraisal costs
- a common, integrated vision of improvement for all elements of an organization
- integration of systems engineering and software engineering environments for additional productivity and quality gains

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CMMI℠

CMMI Helps Organizations to…

Improve delivery of promised performance, cost, and schedule

Collaborate with external stakeholders and manage their expectations

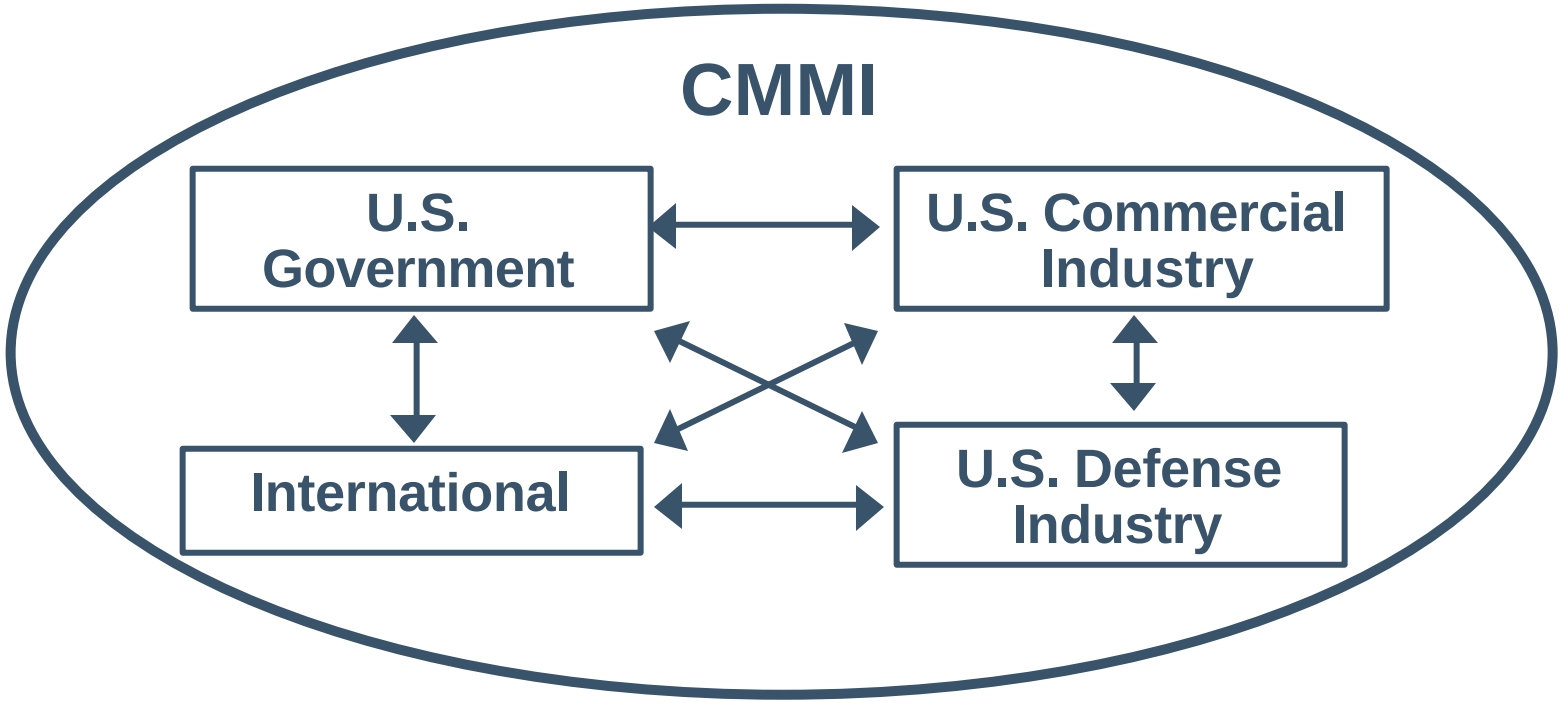
Provide competitive world-class products and services

Implement and integrate enterprise business and engineering perspective

Address system-of-systems evolutionary development complexity

Use common, integrated, and improving processes for systems and software

Process Definition and Improvement



CMMI adoption is very broadly focused and responsive to all communities and stakeholders.

Systems and Software Integration

Systems engineering content and discipline are critical for today's extremely complex systems:

- essential for successful spiral development and evolutionary acquisition processes
- critical for successful technology insertion and technology transition for modern systems

Recent example: lack of systems engineering content and discipline identified as critical factor in complex space systems. **(per Lt Gen Brian A. Arnold, USAF/SMC, 5/6/02 Aviation Week)**

CMMI implementation is major forcing function for needed systems engineering.

ROI Details: NASA MSFC Study, 2001

Kodak: 10:1 or Better Increase in Ratio of Net Present Value to R&D Expenditures, 5 Years

SW Productivity Consortium: 1.2 :1 Increase Productivity

Raytheon: Productivity up 50% to 100% (2:1)

TRW: 1.3:1 Productivity Improvement

Warner Robins ALC: 13:1 Year 2000 Productivity

SPAWAR SSC SEPO: 1.7:1 Defect Reduction (SE)

Ogden ALC: 19:1 Ratio New Contracts After CMM

Software Data:

- **SEI** 5:1 ROI for 13 Organizations
- **Raytheon** 7.7:1. ROI **Hughes** 4.5:1 ROI **Motorola** 3.8: 1 Productivity
- **Boeing** Cost/benefit Ratio 7:1 **Boeing** Productivity 1.6:1
- **DOD Data and Analysis Center** (DACS) 21:1 Contract Win ROI

"R&D Effectiveness" Measured for 5 Years: in excess of 10:1

CMMI Expected Benefits 1

Business/management:

- leverage previous process improvement investments
- extend SW-CMM benefits to the total project/organization
- employ systems engineering principles in software development
- achieve substantial reduction in systems integration and test time with greater probability of success
- cause integration of, and interaction among, the various engineering functions—especially systems engineering

CMMI Expected Benefits 2

Technical:

- more detailed guidance on:
  - requirements development
  - other engineering-related processes
  - systems design and development
  - systems integration
  - risk management
  - measurement & analysis

Discoveries in Use

Appraisal time reflects an excellent learning curve:

- 40% reduction in appraisal time over five Australian appraisals

"Shadow appraisals" show ease of transition:

- high maturity CBA IPI at (former) Litton PRC
- multiple EIA/IS 731 systems engineering assessments
- Level 4 TSP/CMM appraisal highlighted CMMI areas for improvement

Mappings and gap analyses confirm evolutionary expansion from predecessor models:

- government and contractors agree on CMMI's improved engineering coverage in contract monitoring

CMMI Scope and Coverage

Multiple disciplines:
- software engineering
- systems engineering

Products:
- defense
- aerospace
- telecommunications
- manufacturing
- software

Functions:
- discipline integration
- integrated product teams
- acquisition/supplier mgmt

Applications:
- architecture
- design:
  - systems
  - electrical
  - mechanical
  - software
- systems integration & test
- logistics
- total product life cycle

Process Improvement 1

The CMMI model builds on the legacy:

- expanded model scope:
  - risk management
  - verification and validation
  - requirements development and traceability
- better coverage of quantitative engineering management

Process Improvement 2

The CMMI Product Suite provides a foundation for enterprise-wide improvement and adds:

- new emphasis on products and services as well as process
- emphasis on both process capability and organizational maturity
- early emphasis on measurement and analysis

CMMI Framework

CMMI also provides a Framework to which additional disciplines can be added:

- companies have already done this
- Australian Defence Materiel Organisation has done this ("+SAFE")

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CMMI Today 1

Stable version V1.1 released December 2001.

Will NOT change for at least the next few years.

- CMMI Steering Group still directs the CMMI Product Suite

IS being rigorously adopted by many defense, aerospace, and commercial companies and organizations.

CMMI Today 2

CMMI-SW released and on the Web

- applicable to software-only and IT organizations
- BoF tonight 7-9 Grand Mesa F

Formal guidance now available for source selection:

- Standard CMMI® Appraisal Method for Process Improvement (SCAMPI℠), Version 1.1: Method Implementation Guidance for Government Source Selection and Contract Process Monitoring

CMMI Tomorrow

Emphasis through 2003 is on adoption/transition from legacy models:

- quarterly transition workshops
- annual NDIA/SEI CMMI User Workshop (Nov 12-14, Denver Hyatt Technology Center)

Technical notes and special reports will complement V1.1 Product Suite:

- CMMI and Product Line Practices
- CMMI and Earned Value Management
- interpreting CMMI for operational organizations
- mapping CMMI with other standards and models
- adding prototypical coverage for specific interests (e.g., safety, security)

DoD Commitment and International Support

DoD has supported with staff and pilot test sites.

DoD funded SEI's participation in development of CMMI.

DoD has drafted a change to SW-CMM ML3 policy to allow for CMMI.

The plan is that SW-CMM starts sunset Dec 2003, completed by Dec 2005.

Strong international support:

- Australia, Europe, Japan, India

CMMI Early Adopters

Examples:

- Lockheed Martin sees CMMI as a critical driver for Lockheed Martin Integrated Engineering Process Standard.
- Raytheon is implementing CMMI across all engineering and business unit functions for improved performance.
- Northrop Grumman is extending SW-CMM Level 3 benefit to total project through CMMI.
- BAE Systems, Sverdrup, Pratt & Whitney, Harris, TRW, Boeing, and many others have aggressive CMMI adoption plans—as do many of the DoD Services.
- "Early adopter" references are listed on the SEI's Web site: <http://www.sei.cmu.edu/cmmi/adoption/early-adopters.html>

CMM Level 3 Policy Study by OUSD (AT&L) on ACAT-I Programs

Conclusions

Policy is being followed:

- clarifications need to be added
- need to reiterate Level 3 assessment should be independent

Implementation generated positive impact primarily on schedule and cost.

Industry has embraced process and capability maturity.

Systems engineering is considered as important as software.

CMMI Statistics (11/02)

Product Suite Version 1.1 released December 2001 and in use:

- includes SE, SW, IPPD, and SS (Supplier Sourcing)
- baseline model, appraisal method, and training:
  - SCAMPI appraisal method combines internal assessment and external evaluation methods
- transition partners in place:
  - 48 for CMMI introduction training
  - 84 for appraisal services
- lead appraisers available: 142
- number of people trained:
  - introduction to CMMI 5,939*
  - intermediate CMMI 413
  - instructors 125

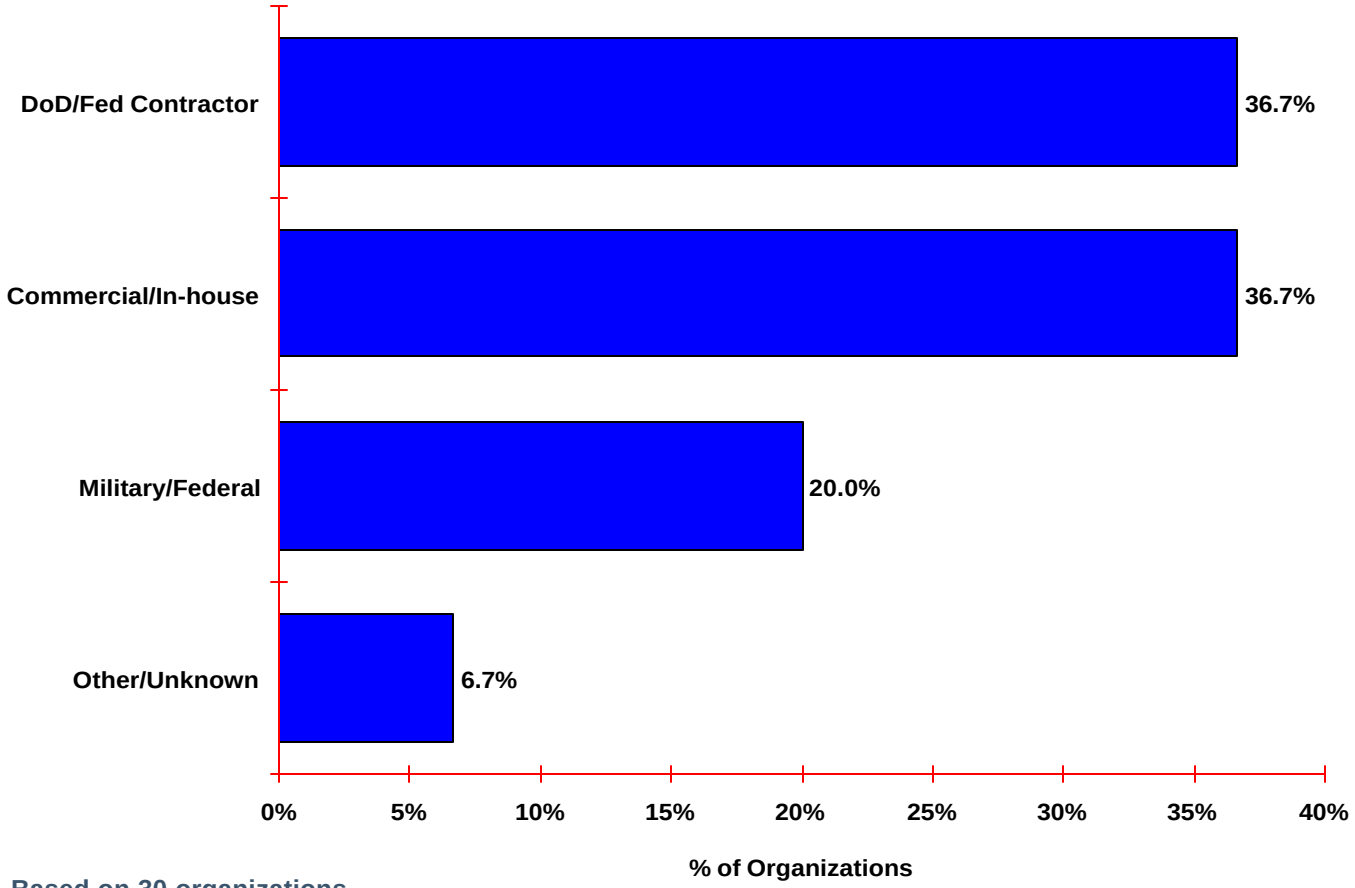
* This number is increasing by 400 every month; July 31 number was 4,259

Early Appraisal Results

SCAMPI appraisals conducted since 1999 and reported to the SEI by July 2002:

34	appraisals
30	organizations
18	participating companies
3	reappraised organizations
125	projects
50%	offshore organizations

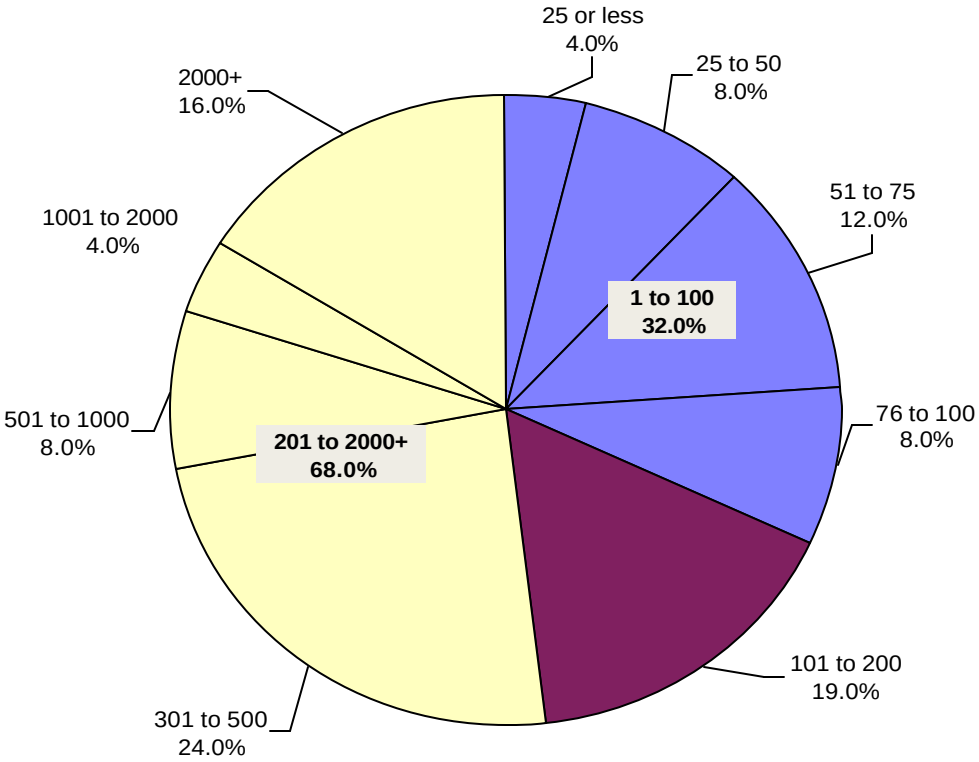
Reporting Organization Types



Based on 30 organizations

Organization Size

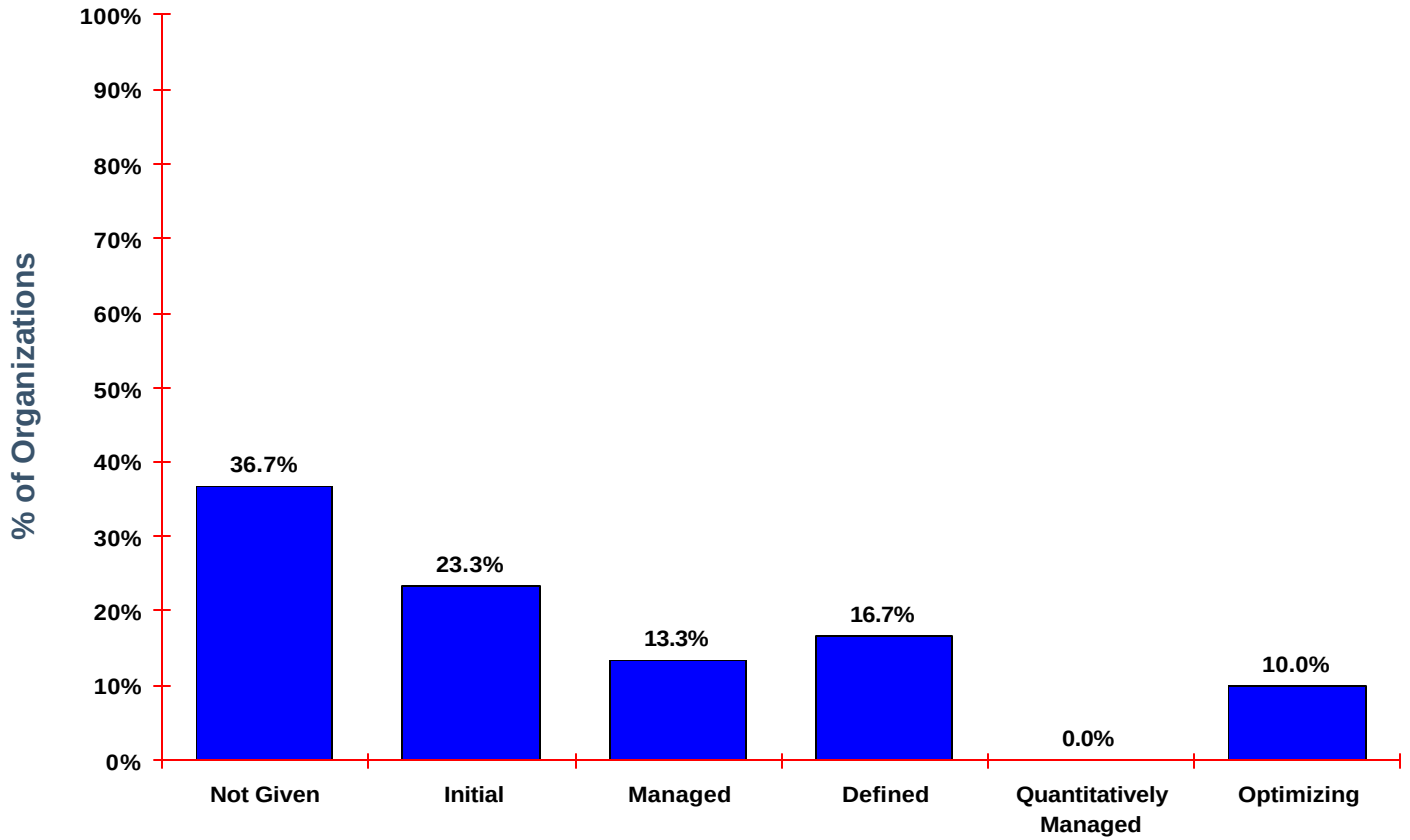
Based on the total number of employees within the area of the organization that was appraised



Based on 25 organizations reporting size data

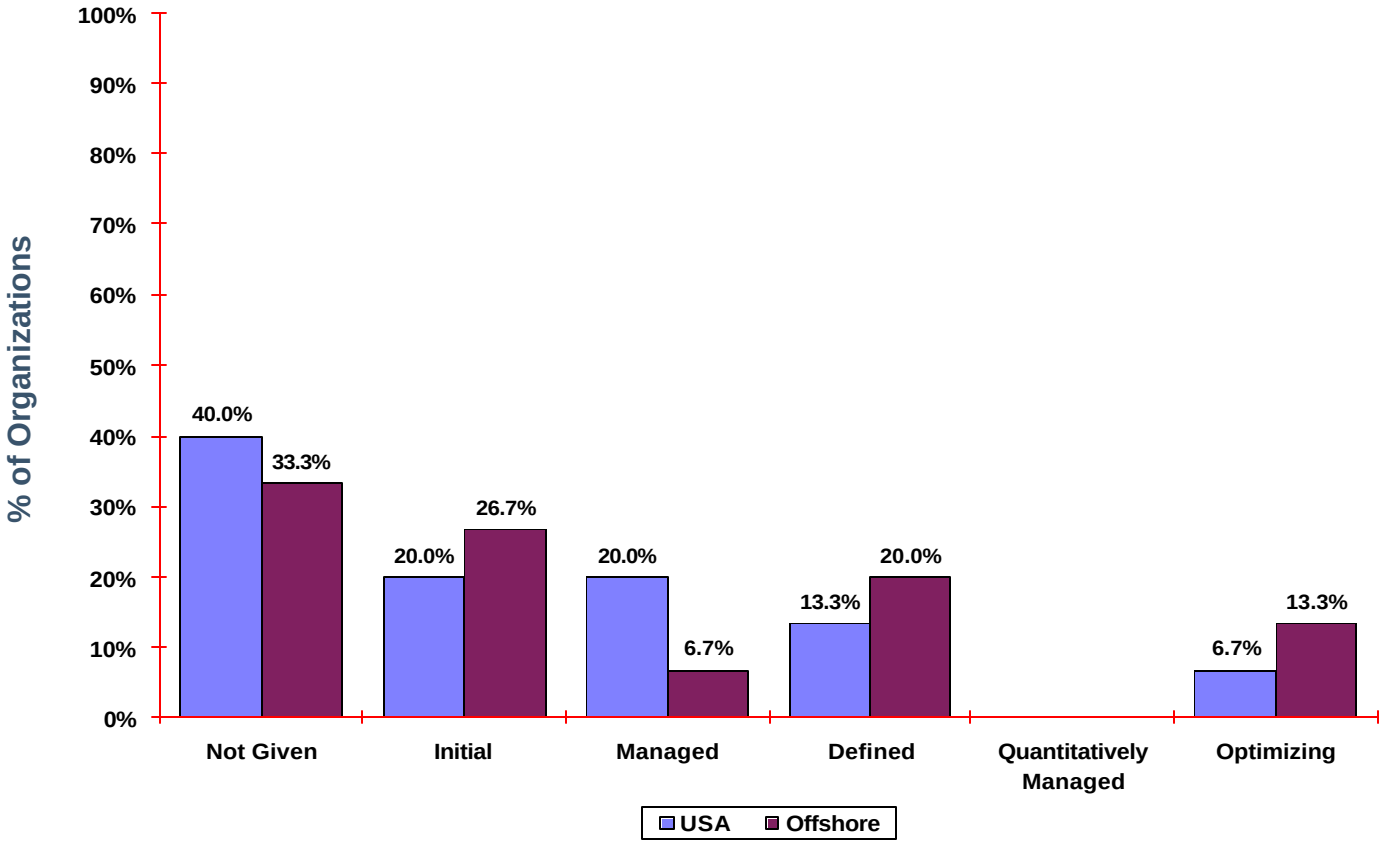
Organization Maturity Profile

August 2002



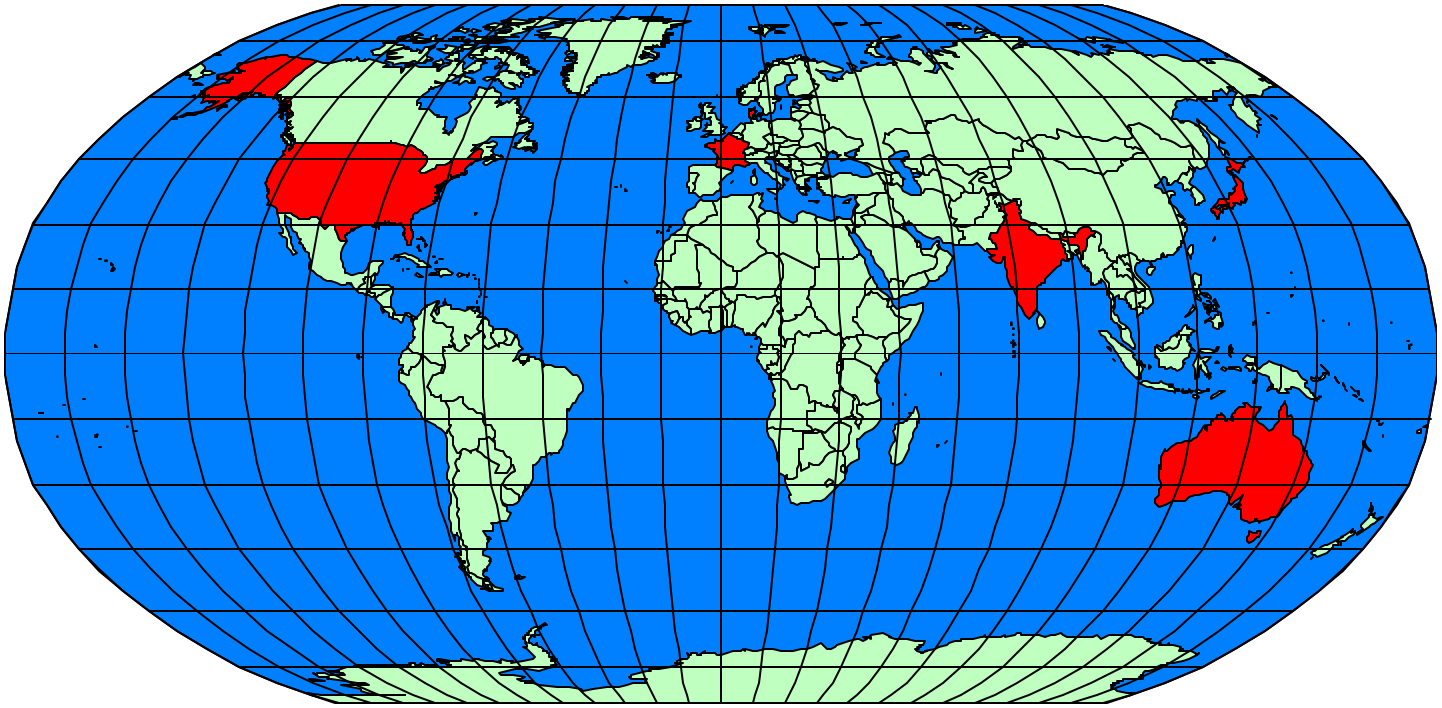
Based on the most recent SCAMPI appraisal reported to the SEI by 30 organizations

USA and Offshore Organization Maturity Profiles



Based on 15 U.S. organizations and 15 offshore organizations

Countries where SCAMPI Appraisals Have Been Performed and Reported



Australia Denmark France India Japan United States

Conclusions

CMMI is being aggressively adopted:

- defense, aerospace, commercial
- US and foreign
- training increasing
- conference attendance increasing
- appraisals, B&C being conducted
- successful transition workshops

Software only version available

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For More Information About CMMI

- Go to CMMI Website:
  - http://www.sei.cmu.edu/cmmi
  - http://www.sei.cmu.edu/cmmi/products/public-release.html>
- Contact SEI Customer Relations:
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