



Carnegie Mellon
Software Engineering Institute

Pittsburgh, PA 15213-3890

CMMI[®] : The Good News and Bad News about Supporting Maturity Concepts

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Capability Maturity Model® (CMM®) Evolution in a Nutshell

**Software CMM® initially developed by the Software Engineering Institute
(circa 1987)**

- **Characterized organizational software process capability in terms of “maturity” as evidenced by the widespread use of desirable practices**
 - **Widely accepted by Government and industry**
 - **Used both for evaluation and self assessment**
 - **Improvements in quality and productivity reported**

A plethora of discipline-specific CMM®’s emerge in the 90’s

- **System Engineering, Integrated Product/Process Dev, Software Acquisition, Security, People and more**

CMMI® v1.1 issued January 2001

- **Adoption of CMMI has been more widespread, and faster, than SW-CMM or any other of the predecessor models**
 - **Case study data shows, when implemented appropriately, significant cost, schedule, defect reduction benefit**



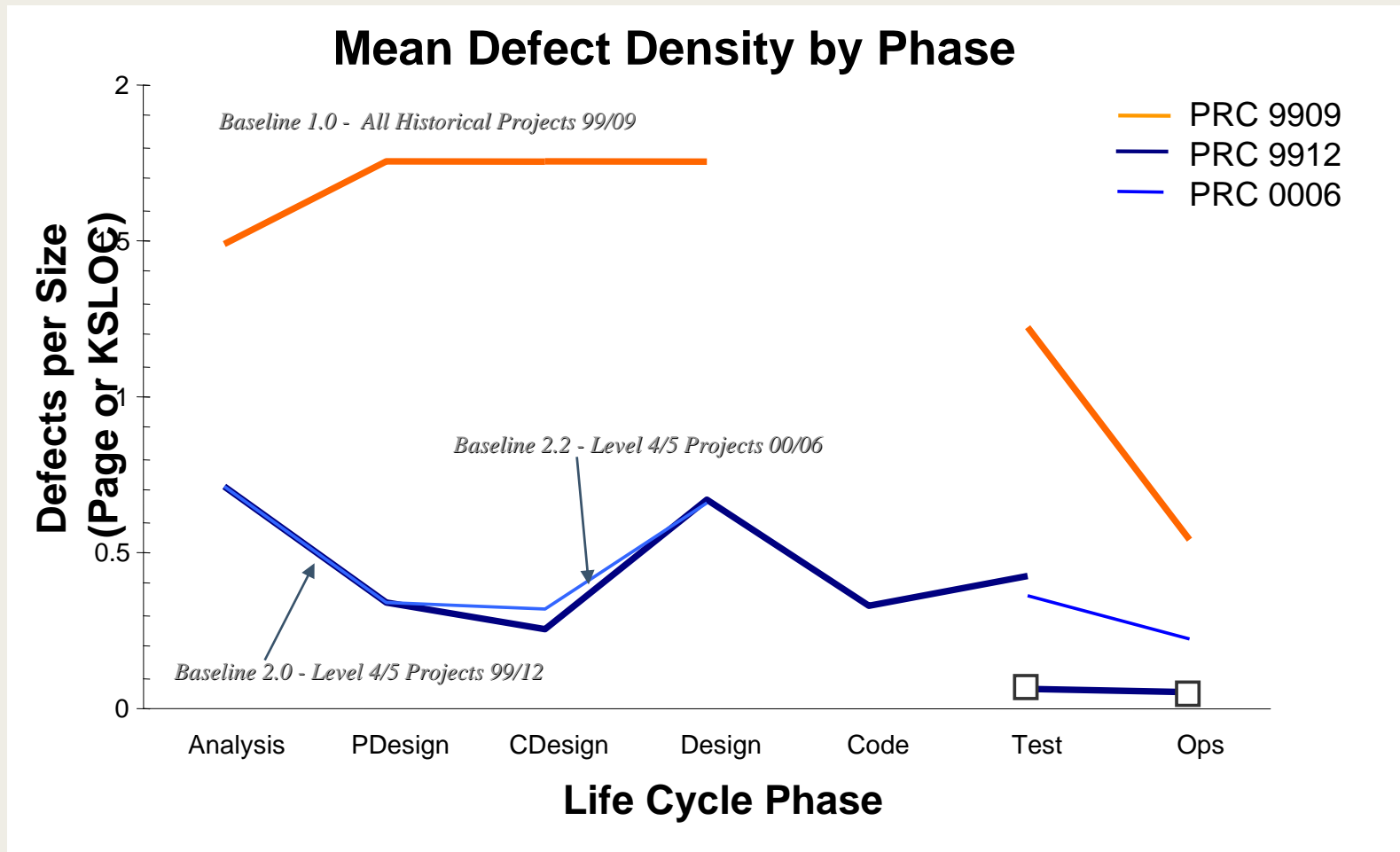
The Bottom Line

SEI has almost 20 years experience supporting various approaches to supporting and evaluating process “maturity”

- Some approaches work better than others
- No approach is perfect
- Stakeholder acceptance (both acquirers and suppliers) is a continual challenge for new concepts



Good news: Case Studies supports Positive Correlation between Process Maturity and Project Factors*



Source: Northrop Grumman Information Technology

*IF improvement efforts are taken seriously and applied consistently



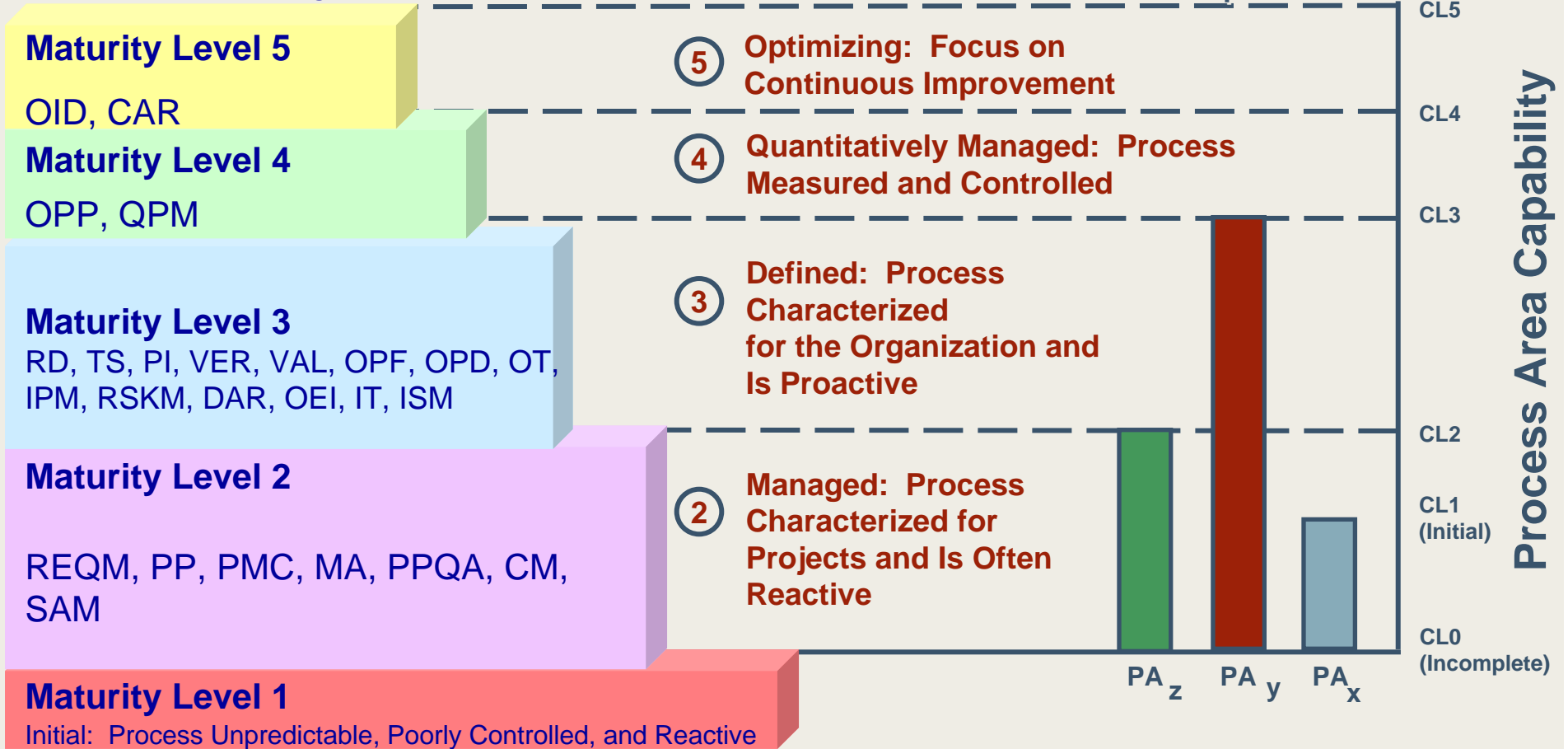
Model Representations

Staged

...for a pre-defined set of process areas across an organization

Continuous

...for a single process area or Selected set of process areas



Essentially the Same Content but Organized in a Different Way.



***Institutionalization* is the Difference Between CMMI and Other Frameworks**

The **Process Capability** dimension of CMMI enables the application of a set of *generic* practices to any process of interest

- This amplifies the utility of the practices and goals expressed in the **Specific Processes** dimension
- When several pre-defined Process Areas are improved along the Process Capability dimension in concert, changes in behavior are observed that lead to a judgment of increasing *organizational maturity*.
 - “High maturity” organizations are sought after by customers due to their lower process risk for executing projects
 - But, lower process risk doesn’t necessarily mean lower risk overall
 - Process is only one dimension of risk that should be accounted for



How “Mature” is CMMI?

Using draft TRLs for Practice-based Technologies, CMMI could be argued as a TRL of 7 or 8:

7:

- Actual system prototype in operational environment
- Implementation needs of mainstream users identified and integrated into the prototype,
- Operational use by relevant users demonstrated across the community

8:

- Final form proven to work in operational environment
- Technology picked-up for wide-spread rollout across the community



CMMI Transition Status – 1/31/05

Training

Introduction to CMMI – 43,758 trained

Intermediate CMMI – 1,923 trained

Introduction to CMMI Instructors – 390

SCAMPI Lead Appraisers – 604 trained

SCAMPI B&C-Only Team Lead -- 29

Authorized

Introduction to CMMI V1.1 Instructors – 302

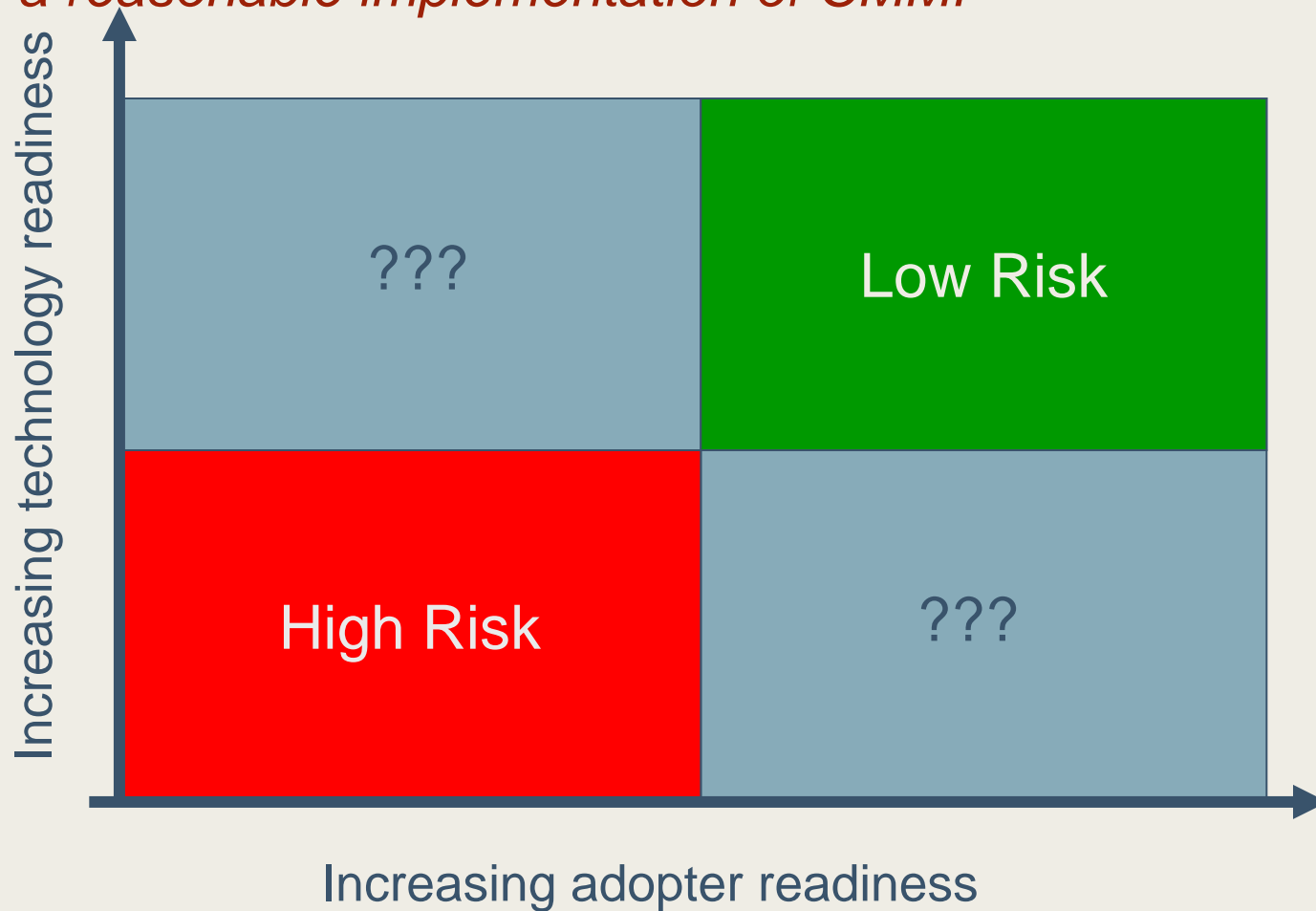
SCAMPI V1.1 Lead Appraisers – 407

SCAMPI B&C Team Leads -- 400



How does that help?

Even less “ready” adopters should be able to find support for a reasonable implementation of CMMI





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Lessons Learned in using Maturity Concepts

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Any model that supports implementing new practices supports assessment

Maturity is an attractive concept to customers

- Implies wisdom, “seasoning”, trustworthiness

Frameworks that support improving the adoption of “best practices” are attractive to organizations seeking operational efficiency

- They don’t have to invent and learn internally about new practices if other organizations have already paved the way

For lots of reasons, these kinds of models lead toward a strong assessment/evaluation viewpoint of compliance to the model/framework

Following slides with adoption/appraisal statistics are from “CMMI Today” presentation which is publicly available and updated 2-3 times per year:

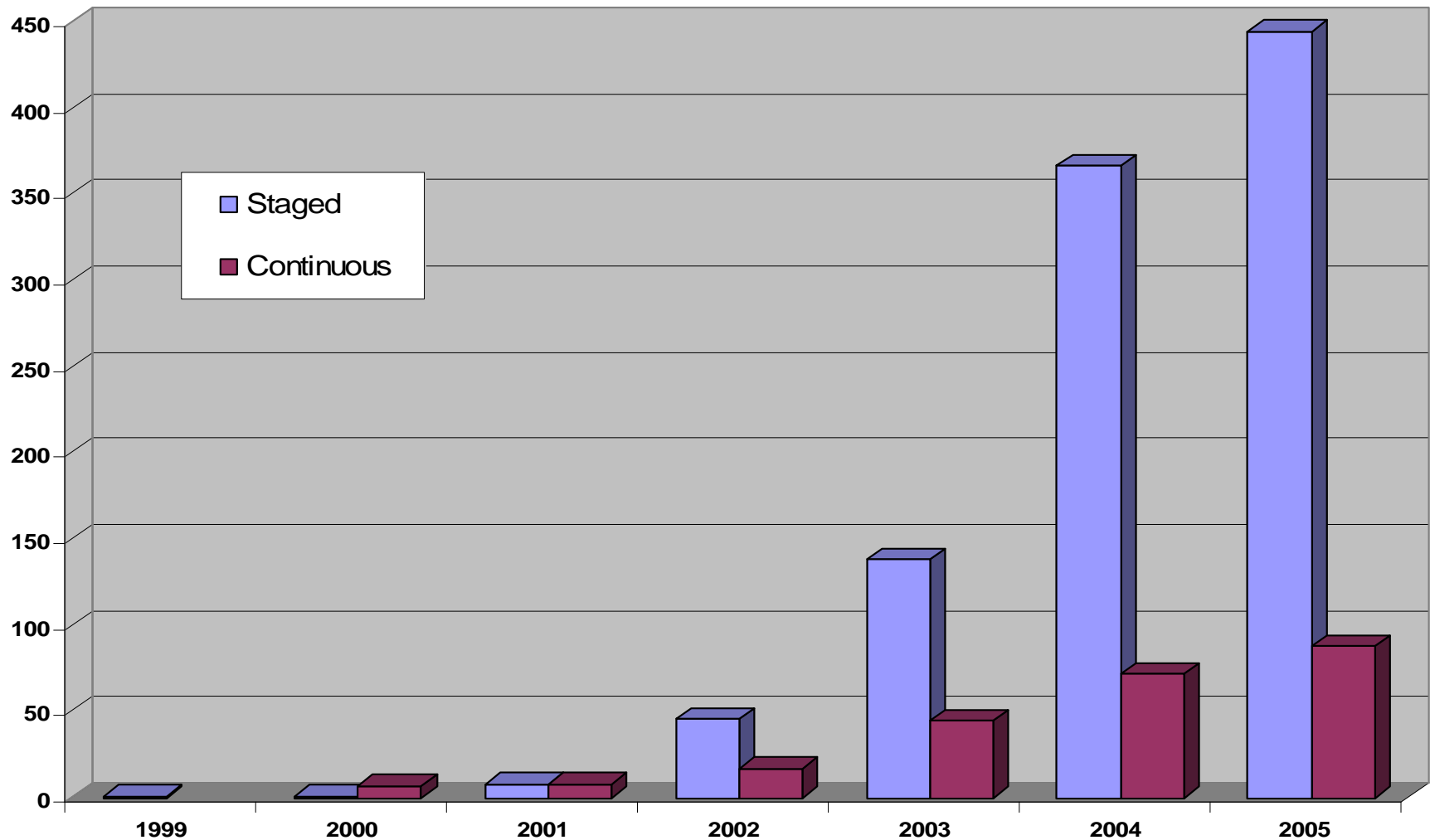
<https://bscw.sei.cmu.edu/pub/bscw.cgi/0/395854>



Number of SCAMPI vX Class A Appraisals Conducted by Year by Model Representation*

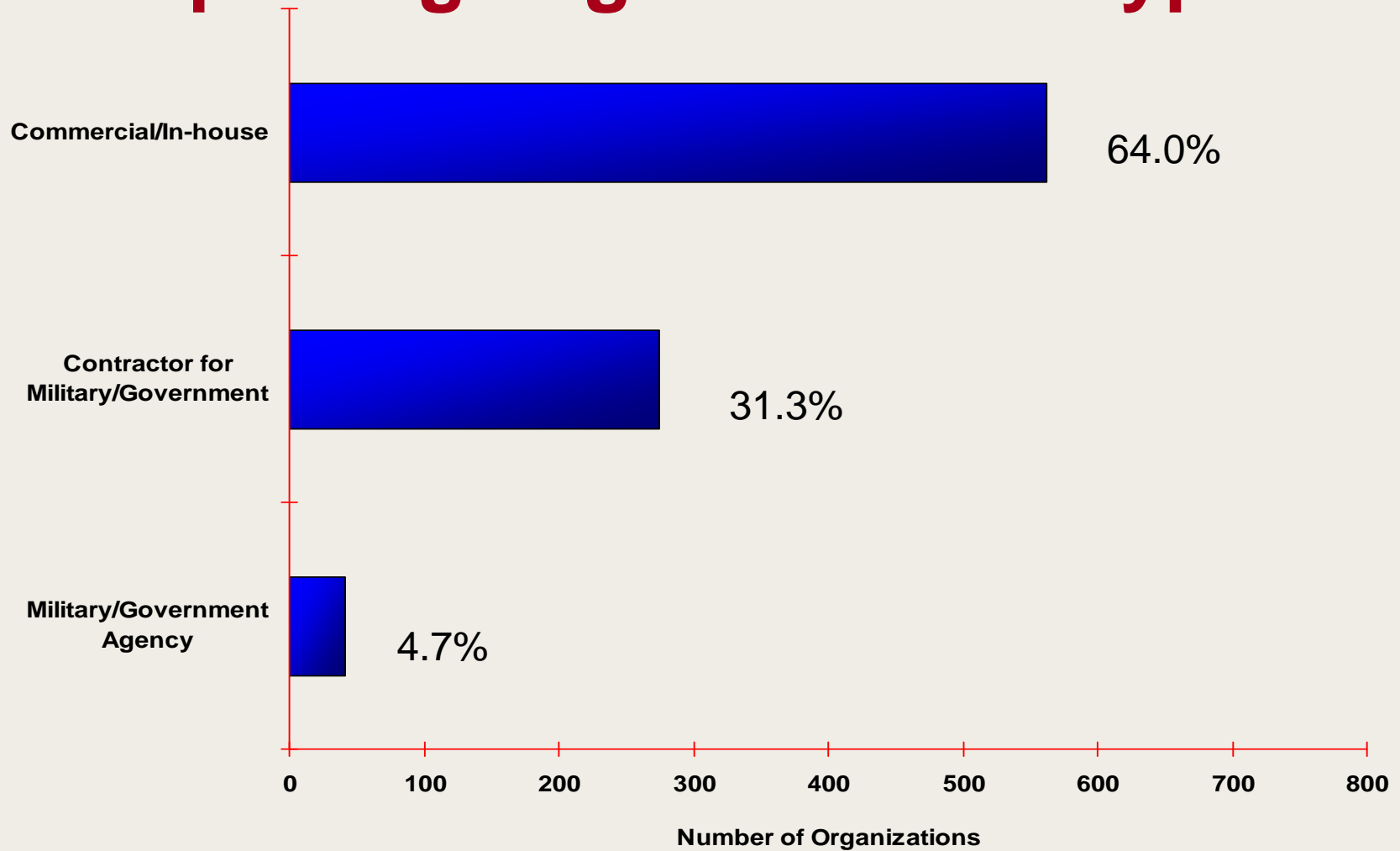
Reported as of 31 January 2006

*Where Representation is reported





Reporting Organizational Types

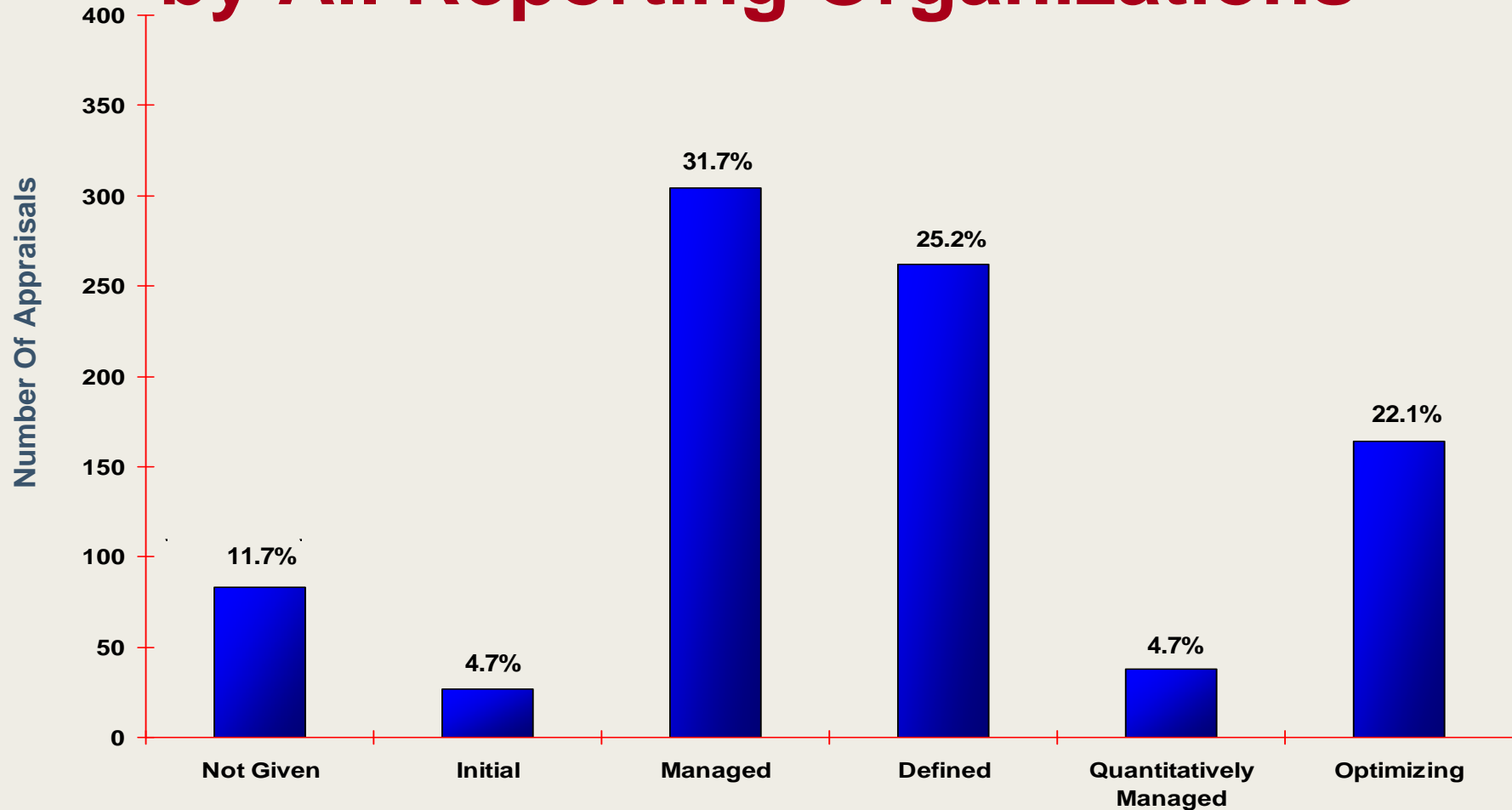


Based on **878** organizations

9/30/05



Maturity Profile by All Reporting Organizations

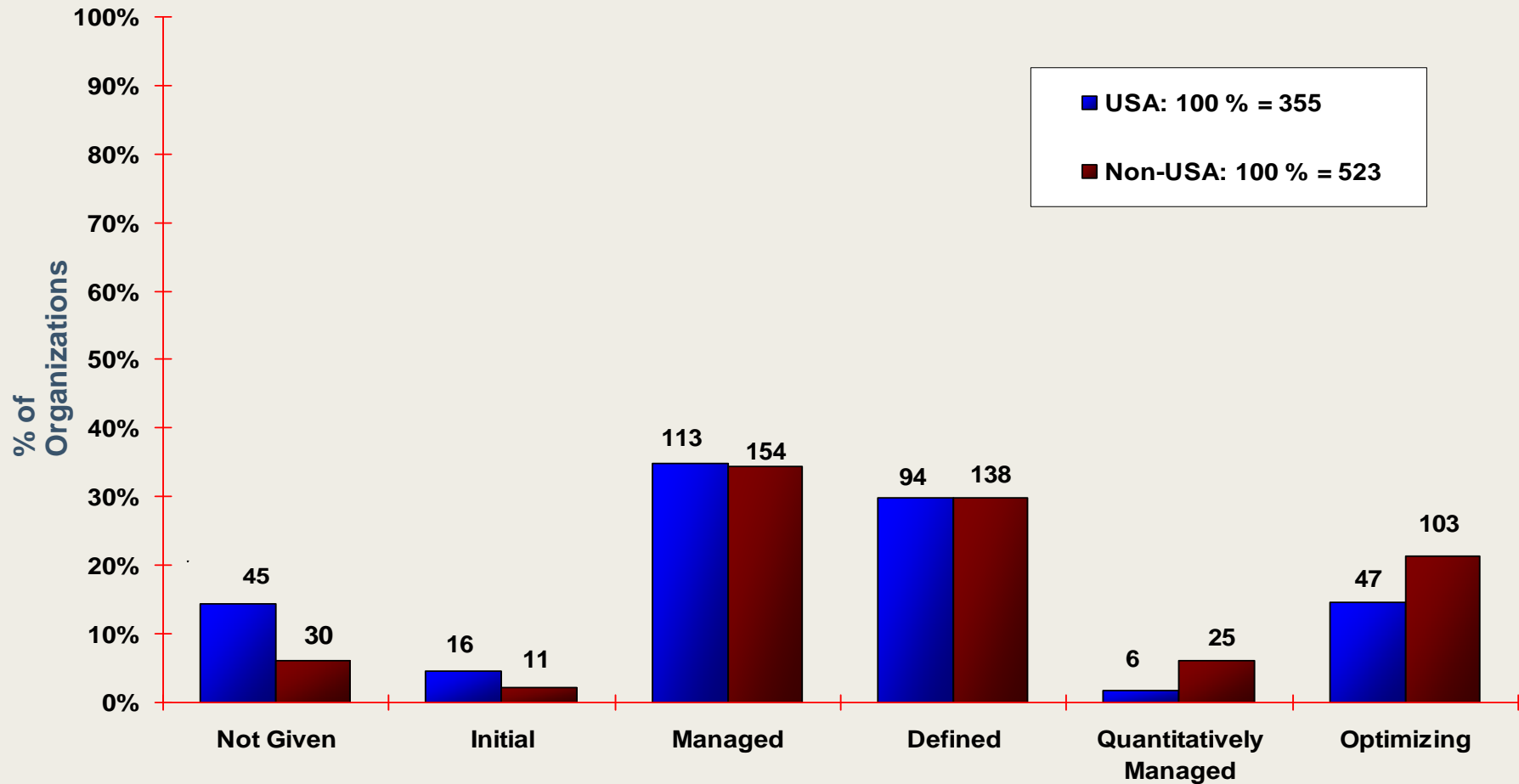


Based on most recent appraisal of **878** organizations

9/30/05



Maturity Profile by All Reporting USA and Non-USA Organizations



Based on 355 USA organizations and 523 Non-USA organizations

9/30/05



The Good News About Strong Assessment Focus

From the model steward's point of view:

- You're careful in assuring that the model is as objective and context-free as possible
- You invest in defining and supporting appraisal methods that include authorization/certification of qualified individuals to perform the assessments
- You seek widespread participation by the stakeholders in the community

If you know you will be one of the "assessed" and you're serious about improvement

- You use the model as leverage to get the resources needed for a robust improvement effort
- You participate in the model development/review to ensure that it doesn't include elements that are irrelevant to your context



The Bad News About Strong Assessment Focus

From the model steward's point of view:

- If you get strong adoption, you'll have a hard time keeping quality of assessor pool high
 - Training and experience requirements will cause delays in getting qualified assessors into the community
- There will always be organizations who “go for the Level” without adopting the behaviors that typically result in actual improvement
 - Educating the customers who demand assessment is one of the ways to reduce over-reliance on assessments to meet goals they were not intended for



Summary

Models and frameworks that address maturity concepts can be very powerful, but they require strong stewardship and significant adoption support

If a rating **can** be assigned, it **will** be assigned

- If you're the developer/steward, the choice you have is to try to support assessments productively, or let them happen without controls on the assessor community

Often customer education is a productive path to reduce issues related to inappropriate use of assessment results



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Backup Slides/Additional Information

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CMMI[®] Maturity Level 2 (Managed) - Process Area List

<i>Process Area</i>	<i>PA Acronym</i>	<i>PA Description</i>
Requirements Management	REQM	Manage the requirements of the project's products and product components and identify inconsistencies between those requirements and the project's plans and work products
Project Planning	PP	Establish and maintain plans that define project activities
Project Monitoring and Control	PMC	Provide understanding into the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan
Supplier Agreement Management	SAM	Manage the acquisition of products and services from suppliers external to the project for which there exists a formal agreement



CMMI[®] Maturity Level 2 (Managed) - Process Area List

<i>Process Area</i>	<i>PA Acronym</i>	<i>PA Description</i>
Process and Product Quality Assurance	PPQA	Provide staff and management with objective insight into the processes and associated work products
Configuration Management	CM	Establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits
Measurement and Analysis	M&A	Develop and sustain a measurement capability that is used to support management information needs



CMMI[®] Maturity Level 3 (Defined)

- Process Area List

<i>Process Area</i>	<i>PA Acronym</i>	<i>PA Description</i>
Organizational Process Focus	OPF	Establish and maintain an understanding of the organization's processes and process assets, and to identify, plan, and implement the organization's process improvement activities
Organizational Process Definition	OPD	Establish and maintain a usable set of organizational process assets
Organizational Training	OT	Develop the skills and knowledge of people so they can perform their roles effectively and efficiently
Risk Management	RSKM	Identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life cycle to mitigate adverse impacts on achieving objectives



CMMI[®] Maturity Level 3 (Defined)

- Process Area List

<i>Process Area</i>	<i>PA Acronym</i>	<i>PA Description</i>
Integrated Project Management	IPM	Establish and manage the project and the involvement of the relevant stakeholders according to an integrated and defined process that is tailored from the organization's set of standard processes
Requirements Development	RD	Produce and analyze customer, product, and product component requirements
Technical Solution	TS	Develop, design, and implement solutions to requirements; solutions, designs and implementations encompass products, product components, and product related processes either singly or in combinations as appropriate



CMMI[®] Maturity Level 3 (Defined)

- Process Area List

<i>Process Area</i>	<i>PA Acronym</i>	<i>PA Description</i>
Product Integration	PI	Assemble the product from the product components, ensure that the product, as integrated, functions properly, and deliver the product
Validation	Val	Demonstrate that a product or product component fulfills its intended use when placed in its intended environment
Verification	Ver	Assure that selected work products meet their specified requirements
Decision Analysis and Resolution	DAR	Make decisions using a structured approach that evaluates identified alternatives against established criteria



CMMI® Maturity Level 4 (Quantitatively Managed) - Process Area List

Process Area	PA Acronym	PA Description
Organizational Process Performance	OPP	Establish and maintain a quantitative understanding of the performance of the organization's set of standard processes, and to provide the process performance data, baselines, and models to quantitatively manage the organization's projects
Quantitative Project Management	QPM	Quantitatively manage the project's defined process to achieve the project's established quality and process performance objectives



CMMI® Maturity Level 5 (Optimizing) - Process Area List

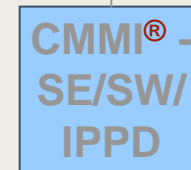
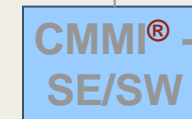
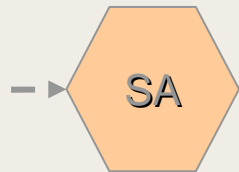
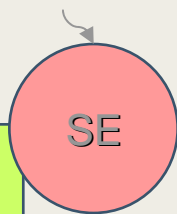
Process Area	PA Acronym	PA Description
Causal Analysis and Resolution	CAR	Identify causes of defects and other problems and take action to prevent them from occurring in the future
Organizational Innovation and Deployment	OID	Select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies



CMMI® Source Models

EIA Interim Standard 731,
System Engineering
Capability Model (SECM)

Capability Maturity
Model® for Software V2,
draft C (SW-CMM® V2C)



...

Integrated Product
Development Capability
Maturity Model®, draft
V0.98 (IPD-CMM®)

Software Acquisition
Capability Maturity
Model® (SA-CMM®)

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