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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*

Mean Defect Density by Phase
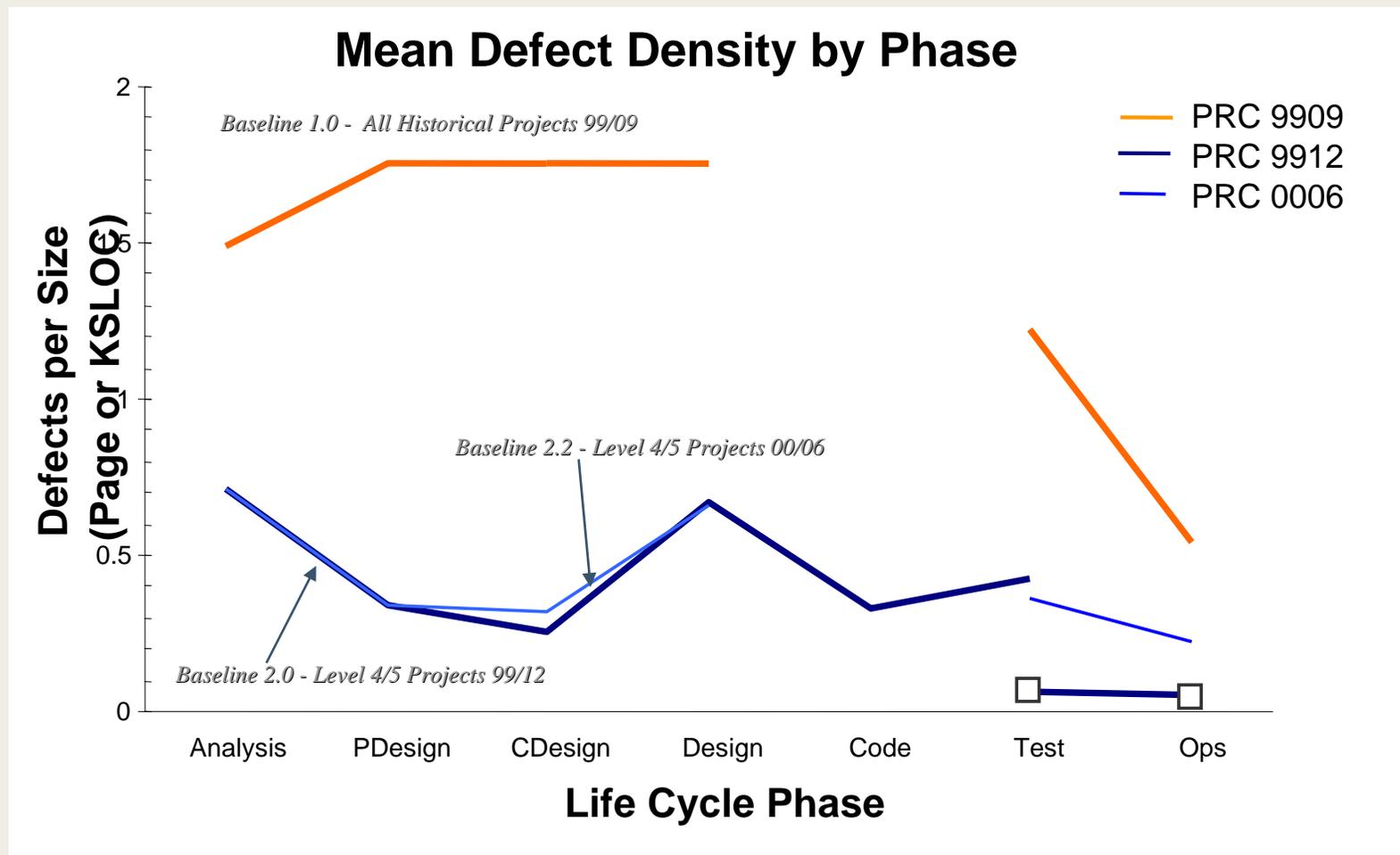
Source: Northrop Gruman Information Technology

*IF improvement efforts are taken seriously and applied consistently

Smg GAO Mtg 3/25/03 page 4
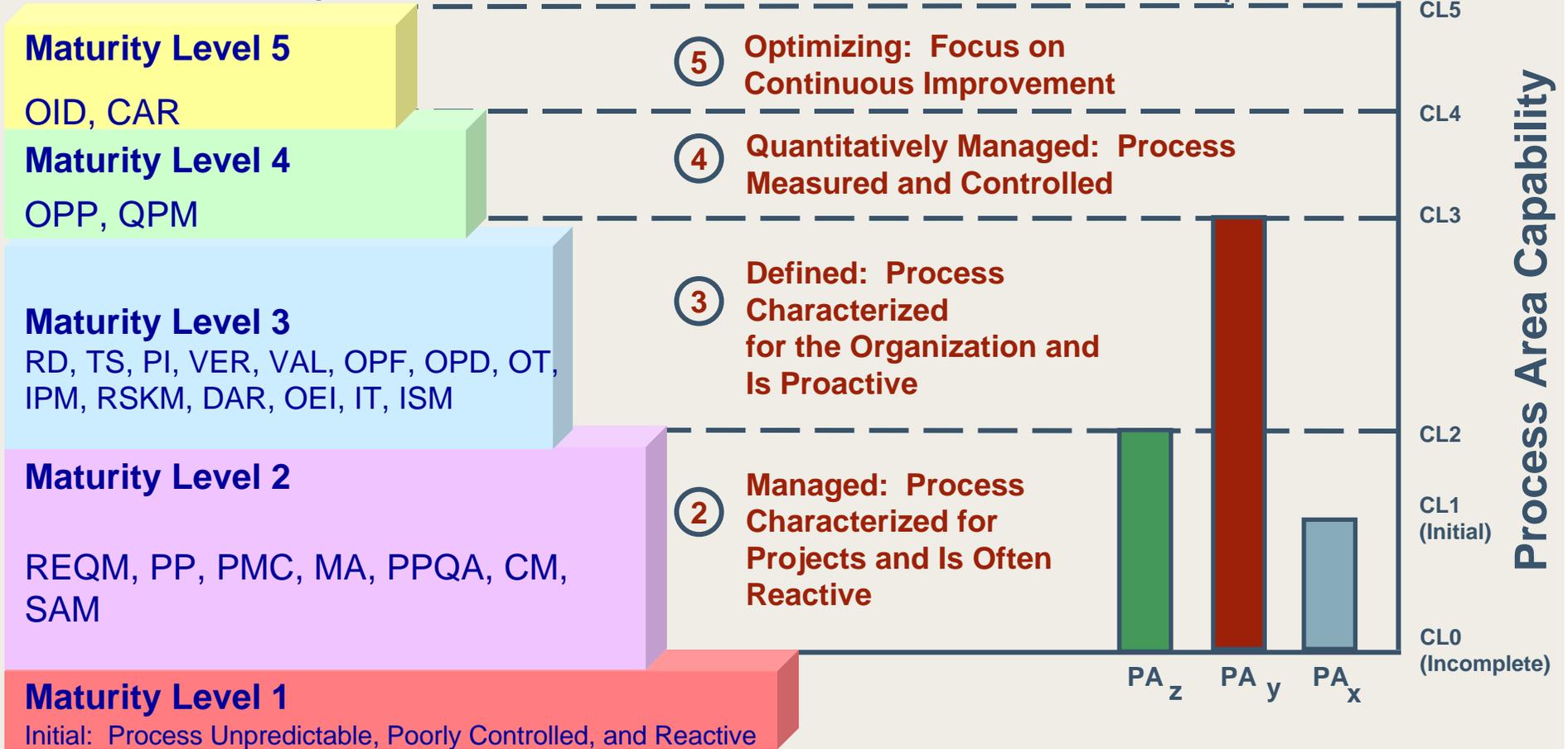
Institutionalization is the Difference Between CMMI and Other Frameworks

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

Increasing technology readiness (vertical axis)

Increasing adopter readiness (horizontal axis)

Quadrants:
- Top left: ???
- Top right: Low Risk
- Bottom left: High Risk
- Bottom right: ???
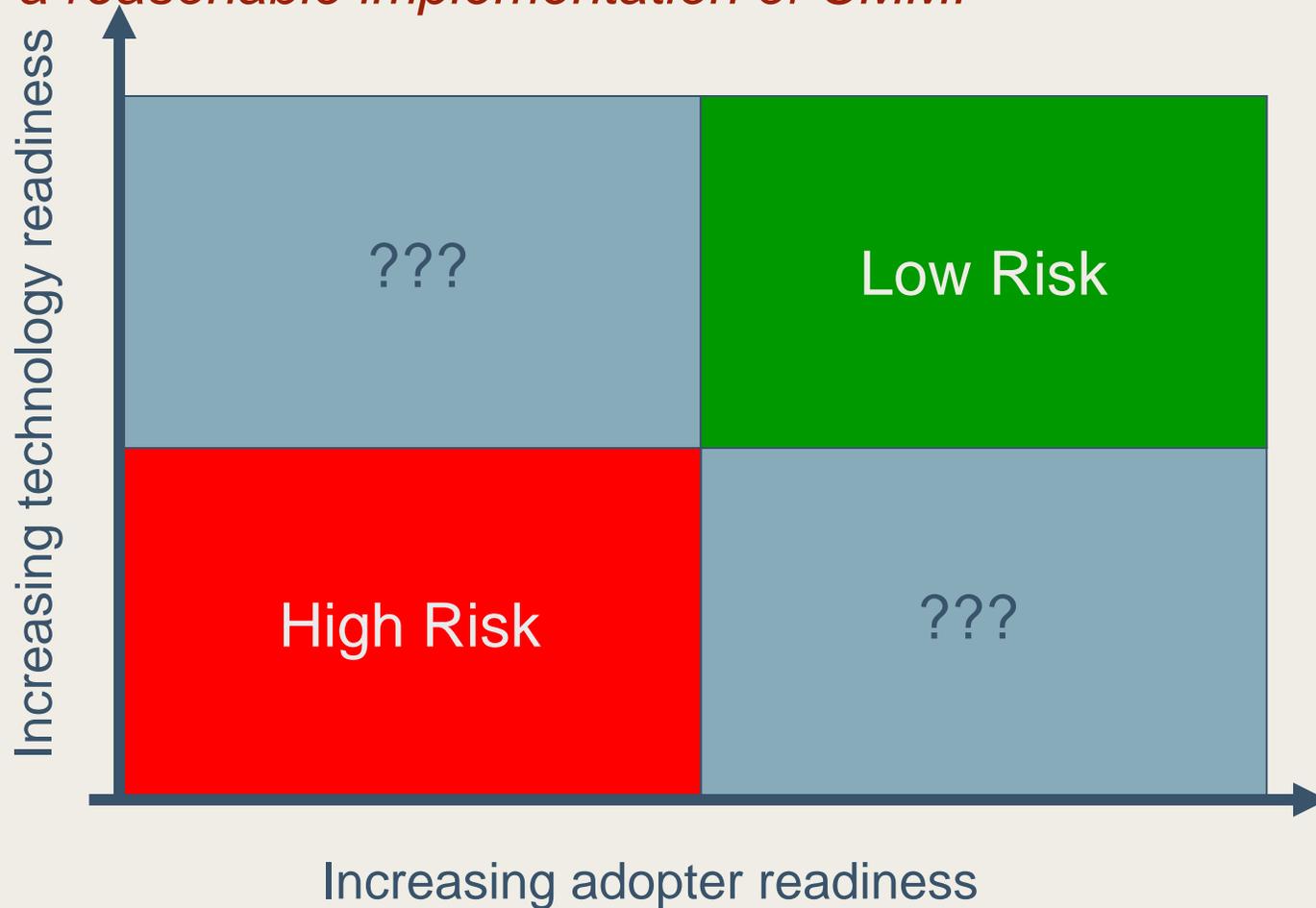
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Lessons Learned in using Maturity Concepts

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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

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Number of SCAMPI vX Class A Appraisals Conducted by Year by Model Representation*
Reported as of 31 January 2006
*Where Representation is reported
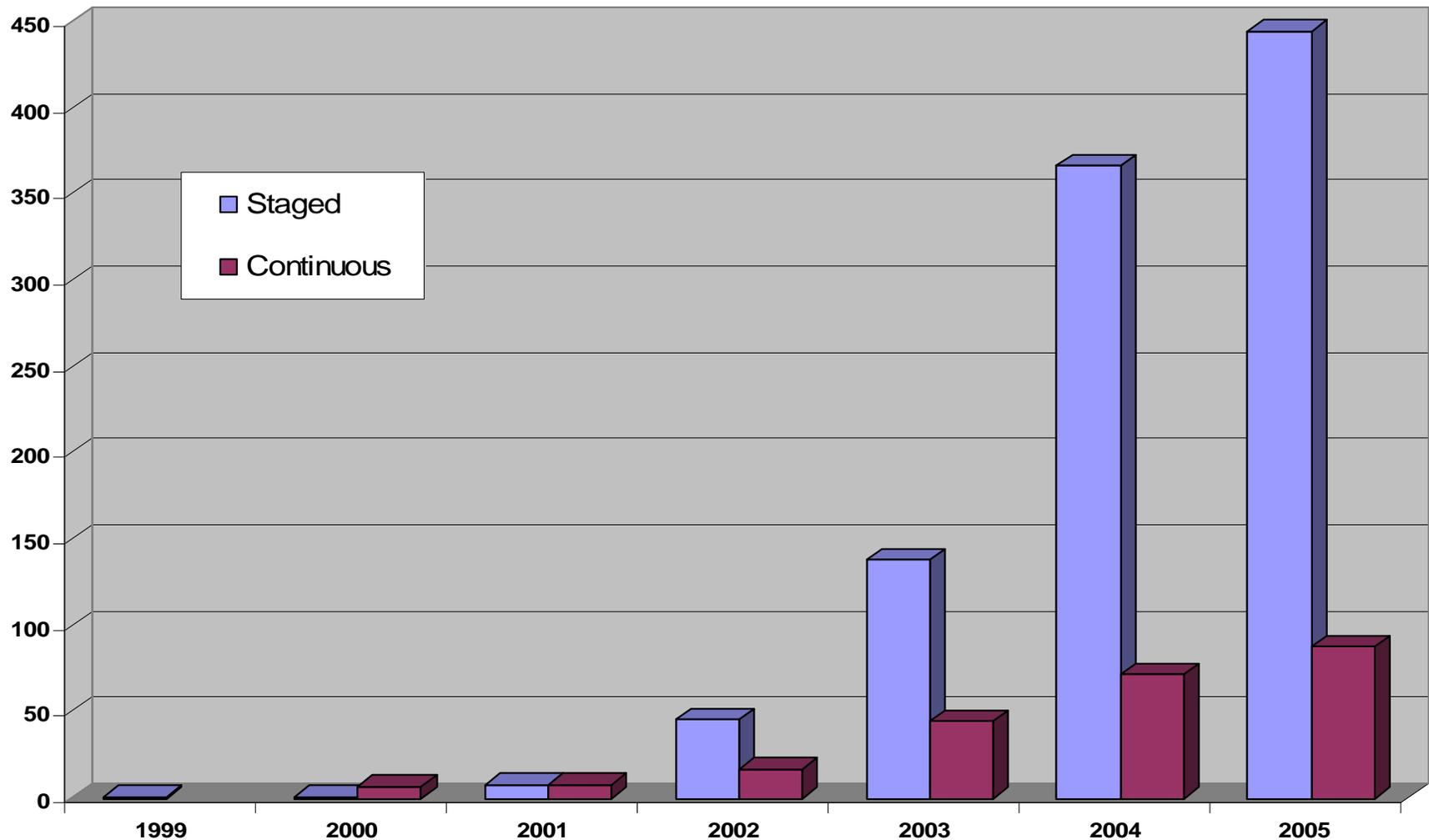
Maturity Profile
by All Reporting Organizations
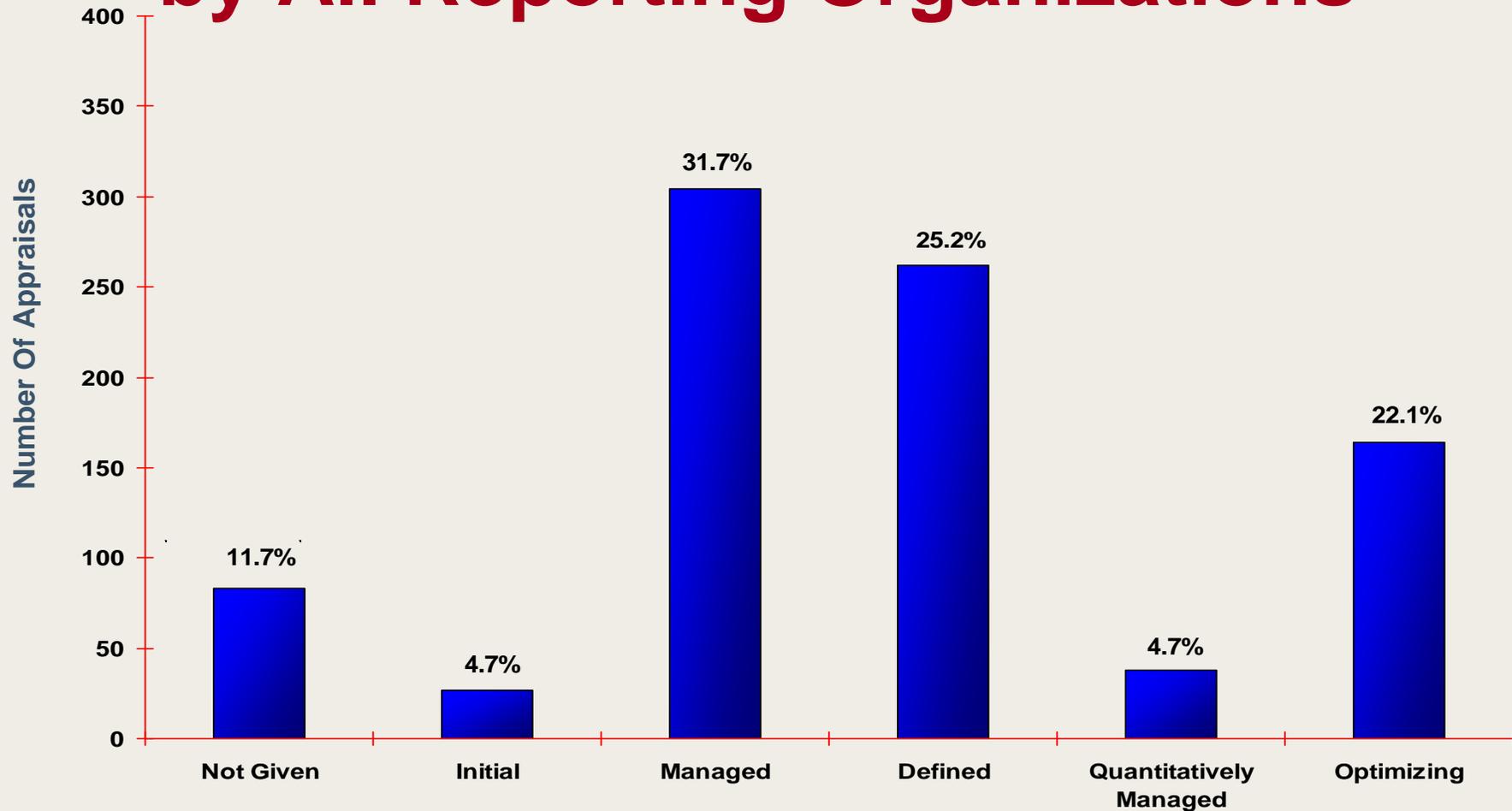
Based on most recent appraisal of **878** organizations

Maturity Profile by All Reporting USA and Non-USA Organizations

% of Organizations

Legend:
- USA: 100 % = 355
- Non-USA: 100 % = 523

Category	USA	Non-USA
Not Given	45	30
Initial	16	11
Managed	113	154
Defined	94	138
Quantitatively Managed	6	25
Optimizing	47	103
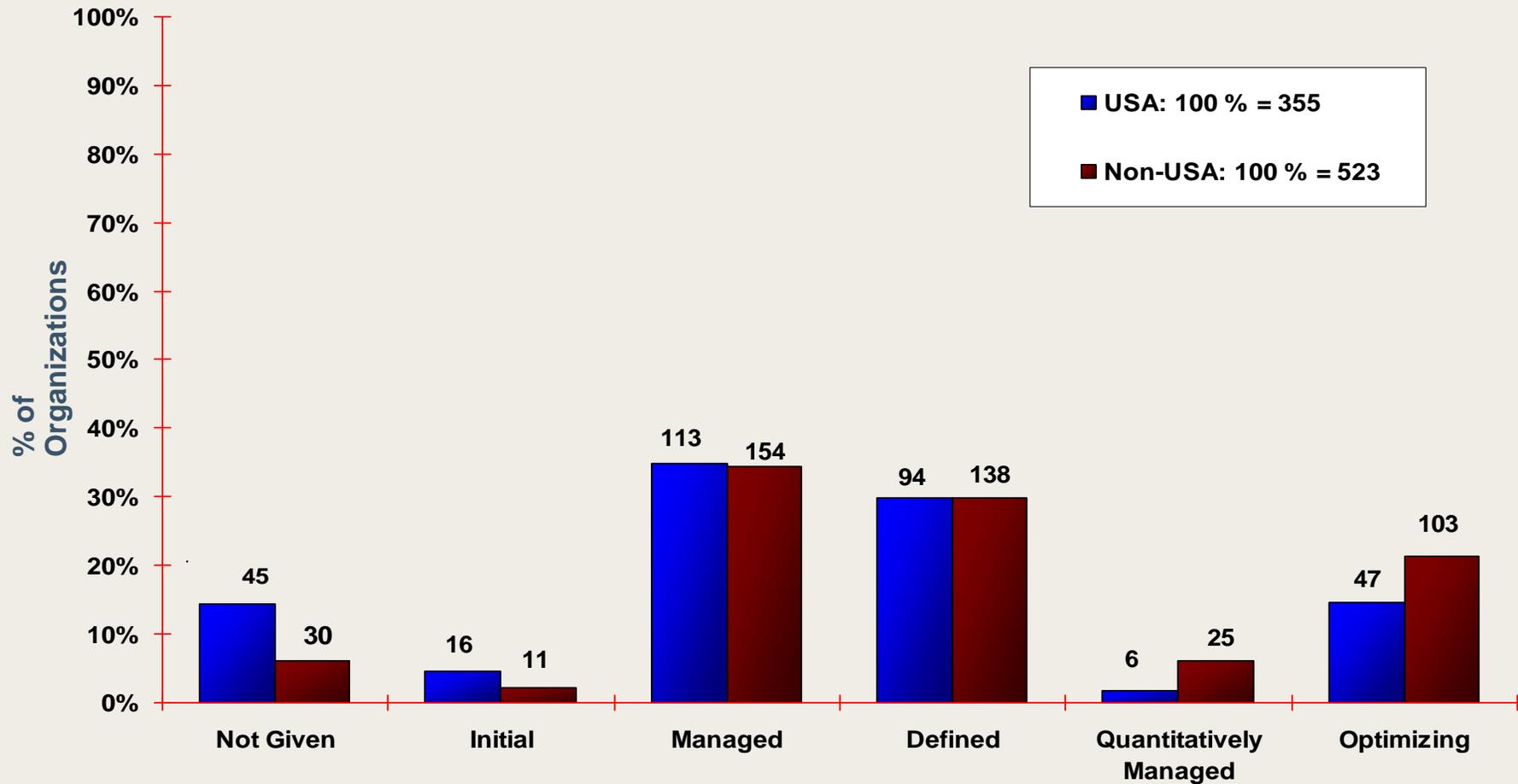
Based on **355** USA organizations and **523** Non-USA organizations

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

Backup Slides/Additional Information

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

Process Area	PA Acronym	PA Description
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 Managemen	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

Process Area	PA Acronym	PA Description
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

Process Area	PA Acronym	PA Description
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

Process Area	PA Acronym	PA Description
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

Process Area	PA Acronym	PA Description
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)
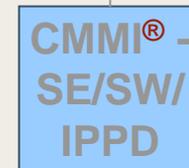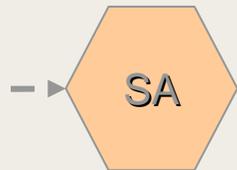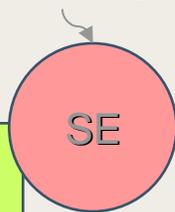
Integrated Product Development Capability Maturity Model®, draft V0.98 (IPD-CMM®)

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

SE

SW

IPPD

Assess

Training

SA

Industry

SEI

Government

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

CMMI® Product Suite

CMMI® - SE/SW

CMMI® - SE/SW/ IPPD

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