"Demystifying the SEI CMMI"

Capability Maturity Model® Integration (CMMI)
Software Engineering Institute (SEI)
Carnegie Mellon University

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Society of PM Professionals
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"IT and IS Projects"
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“Most software projects fail.

In fact, the Standish group reports that over 80% of projects are unsuccessful either because they are over budget, late, missing function, or a combination.

Moreover, 30% of software projects are so poorly executed that they are cancelled before completion.”

“BEST PRACTICES FOR SOFTWARE DEVELOPMENT PROJECTS”
MIKE PERKS (MPERKS@US.IBM.COM) SOLUTION ARCHITECT
IBM SOFTWARE SERVICES FOR WEBSPHERE
16 JUN 2003 - UPDATED 10 AUG 2006

HTTP://WWW.IBM.COM/DEVELOPERWORKS/WEBSPHERE/LIBRARY/TECHARTICLES/0306_PERKS/PERKS2.HTML

YEAR	COMPANY	OUTCOME (COSTS IN US $)
2005	Hudson Bay Co. [Canada]	Problems with inventory system contribute to $33.3 million* loss.
2004–05	UK Inland Revenue	Software errors contribute to $3.45 billion* tax-credit overpayment.
2004	Avis Europe PLC [UK]	Enterprise resource planning (ERP) system canceled after $54.5 million† is spent.
2004	Ford Motor Co.	Purchasing system abandoned after deployment costing approximately $400 million.
2004	J Sainsbury PLC [UK]	Supply-chain management system abandoned after deployment costing $527 million.†
2004	Hewlett-Packard Co.	Problems with ERP system contribute to $160 million loss.
2003–04	AT&T Wireless	Customer relations management (CRM) upgrade problems lead to revenue loss of $100 million.
2002	McDonald's Corp.	The Innovate information-purchasing system canceled after $170 million is spent.
2002	Sydney Water Corp. [Australia]	Billing system canceled after $33.2 million† is spent.
2002	CIGNA Corp.	Problems with CRM system contribute to $445 million loss.
2001	Nike Inc.	Problems with supply-chain management system contribute to $100 million loss.
2001	Kmart Corp.	Supply-chain management system canceled after $130 million is spent.
2000	Washington, D.C.	City payroll system abandoned after deployment costing $25 million.
1999	United Way	Administrative processing system canceled after $12 million is spent.
1999	State of Mississippi	Tax system canceled after $11.2 million is spent; state receives $185 million damages.
1999	Hershey Foods Corp.	Problems with ERP system contribute to $151 million loss.
1998	Snap-on Inc.	Problems with order-entry system contribute to revenue loss of $50 million.
1997	U.S. Internal Revenue Service	Tax modernization effort canceled after $4 billion is spent.
1997	State of Washington	Department of Motor Vehicle (DMV) system canceled after $40 million is spent.
1997	Oxford Health Plans Inc.	Billing and claims system problems contribute to quarterly loss; stock plummets, leading to $3.4 billion loss in corporate value.
1996	Arianespace [France]	Software specification and design errors cause $350 million Ariane 5 rocket to explode.

Closer to Home

- The Canadian Federal Government has spent over $2 billion on a Gun Registry that is nothing more than a giant database for storing information about legal owners of guns who have volunteered to register their weapons. – 2000-2009

- eHealth scandal a $1B waste: auditor
- A scathing report on the eHealth Ontario spending scandal charges that successive governments wasted $1 billion in taxpayer money. – 2000-2009

Agenda – 1/2

- Typical Problems During the Software Life Cycle (SLC)
- Why Focus on Process?
- Benefits of SEI CMMI
- CMMI® for Development, Version 1.2
  - 22 CMMI Process Areas
  - Capability Levels vs. Maturity Levels
  - Four Categories of CMMI Process Areas
    - Process Management
    - Project Management
    - Engineering
    - Support
  - Generic Practices and Practices
    - Common Feature
    - Institutionalization

Agenda – 2/2

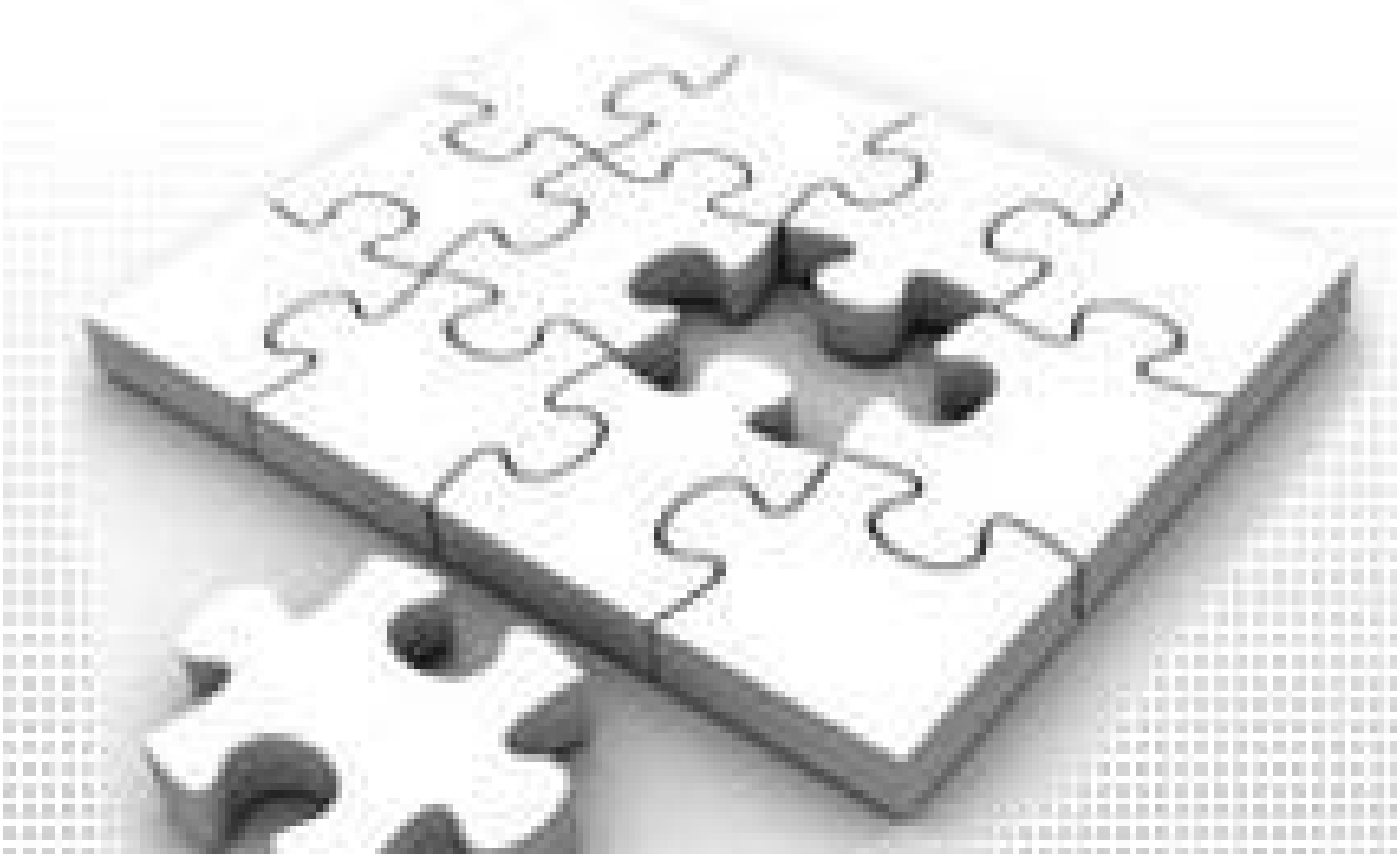
- Appendix A:
  Four Categories of CMMI Process Areas

- Appendix B:
  The Operational Framework

- Appendix C:
  The IDEAL Model

- Appendix D:
- The SEI Capability Maturity Models (CMMs)

Does Your Organization Know the Maturity of the Processes ?



Typical Problems During the Software Life Cycle (SLC)

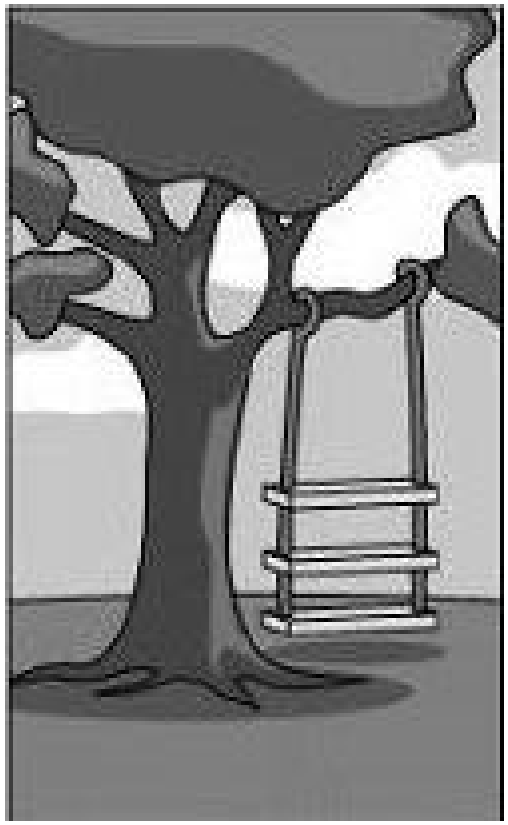
A Simple illustration

Borrowed from:

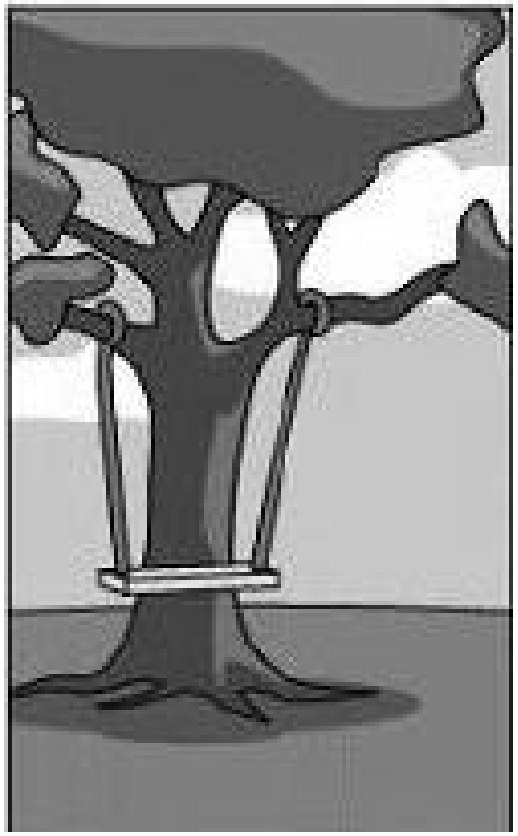
http://scott.yang.id.au/2003/08/software-development-life-cycle/

Typical Problems During the Software Life Cycle (SLC) - 2/6

- How the customers explained it

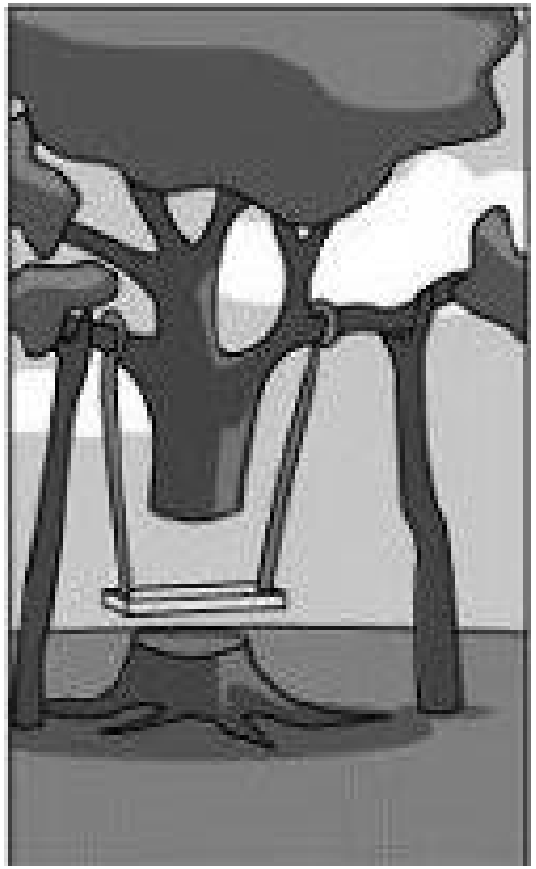


- How the Project Leader understood it

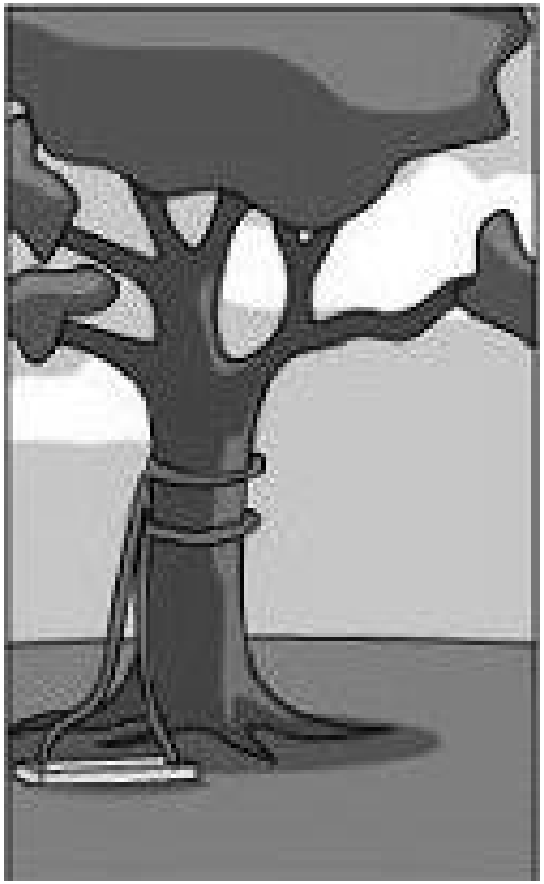


Typical Problems During the Software Life Cycle (SLC) - 3/6

- How the Analyst designed it

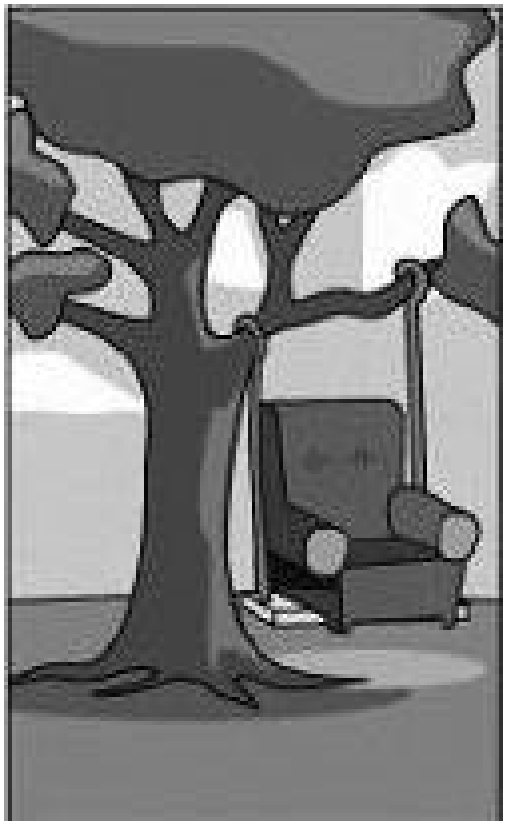


- How the Programmer wrote it

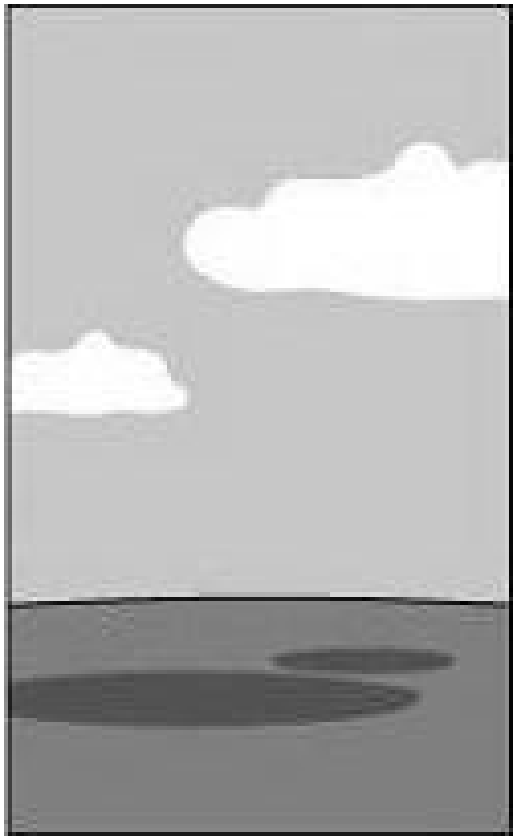


Typical Problems During the Software Life Cycle (SLC) - 4/6

- How the Business Consultant described it

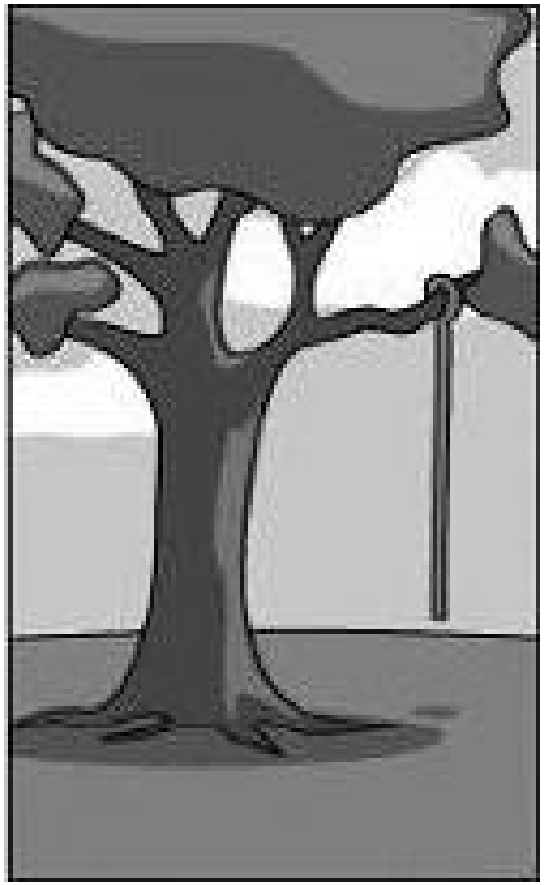


- How the project was Documented

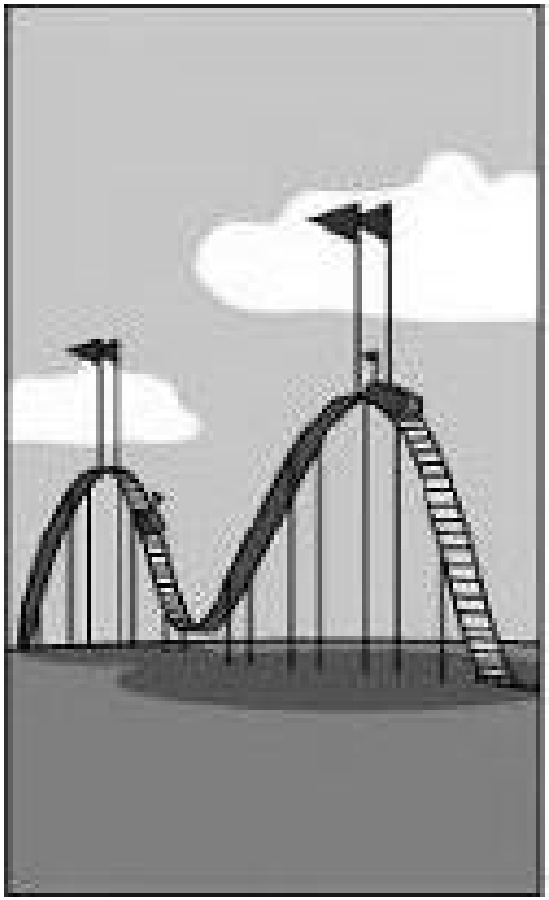


Typical Problems During the Software Life Cycle (SLC) - 5/6

- What operations installed

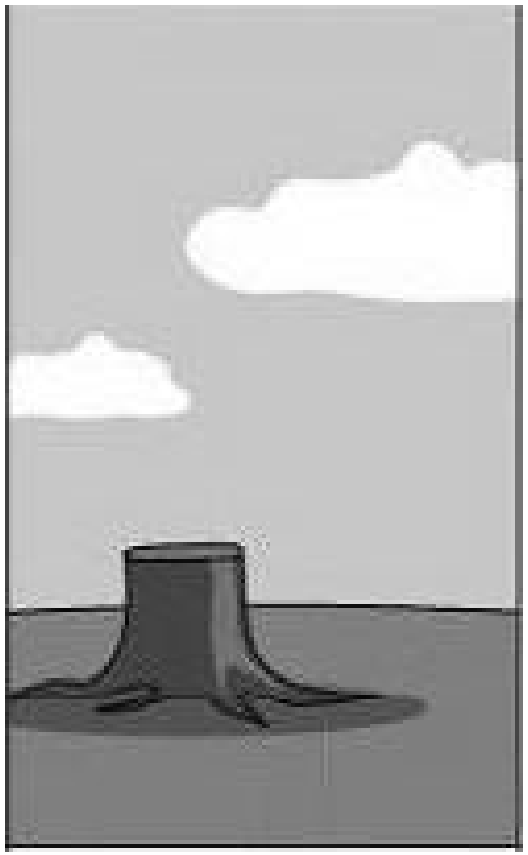


- How the customer was billed

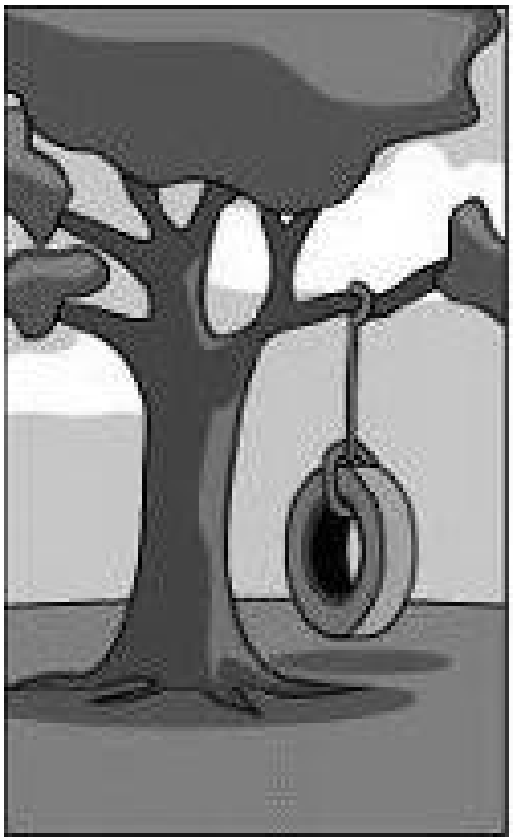


Typical Problems During the Software Life Cycle (SLC) - 6/6

- How it was supported



- What the customer really needed



Why Focus on Process ?

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

A long-established premise in manufacturing

Have You Experienced These Symptoms?

- Missed commitments
  - Spiralling costs
  - Late delivery to the market
  - Last-minute crunches
- Inadequate management visibility
  - Too many surprises
- Quality problems
  - Customer complaints
  - Too much rework
  - Functions not working correctly
- Poor morale
  - Burned-out people
  - Inadequate control of project results

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)

How Do You Want to Work?

- Random motion – lots of energy, not much progress
  - No teamwork – individual effort
  - Frequent conflict
  - You never know where you'll end up

- Directed motion – every step brings you closer to the goal
  - Coordinated efforts
  - Cooperation
  - Predictable results

Why Focus on Process?

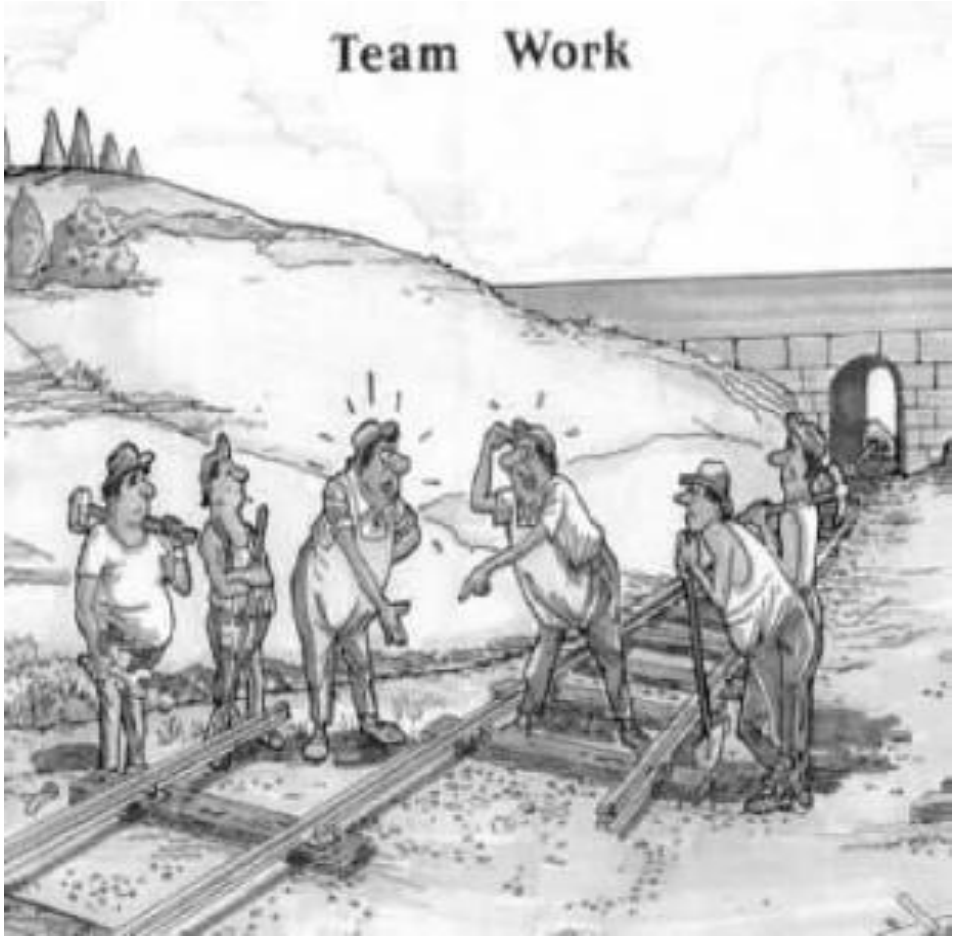
- It complements your focus on technology:
  - Technology, by itself, will most likely not be used effectively.
  - Technology, in the context of an appropriate process roadmap, can provide the most benefit.

- It complements your focus on people:
  - The experience and training of your work force is not always enough.
  - Working harder is not the answer.
  - A well-defined process can provide the means to work smarter.
  - It shifts the “blame” for problems from people to the process.

Common Fallacies

- I don’t need process,
- I have …
  - really good people
  - advanced technology
  - an experienced manager
- Process …
  - interferes with creativity
  - introduces bureaucracy and regimentation
  - isn’t needed when building prototypes
  - is only useful on large projects
  - hinders agility in fast-moving markets
  - costs too much

Could your Organization Benefit from Process Improvement ?



Benefits of SEI CMMI

CMMI is a process improvement approach that provides organizations with the essential elements of effective processes that ultimately improve their performance.

CMMI can be used to guide process improvement across a project, a division, or an entire organization.

Performance Results: CMMI

- The next slide provides examples from 25 different organizations that achieved benefits in one or more of the following six categories of performance measures:
  - Cost
  - Schedule
  - Productivity
  - Quality
  - Customer Satisfaction
  - Return on Investment

Performance Measures

Improvements	Median	# of Data Points	Low	High
Cost	20%	21	3%	87%
Schedule	37%	19	2%	90%
Productivity	62%	17	9%	255%
Quality	50%	20	7%	132%
Customer Satisfaction	14%	6	-4%	55%
ROI	4.7 : 1	16	2:1	27.7 : 1

Examples of Impact: Schedule*

- 50% reduction in release turn around time (Boeing, Australia)
- Increased the percentage of milestones met from approximately 50 percent to approximately 95 percent (General Motors)
- Decreased the average number of days late from approximately 50 to fewer than 10 (General Motors)
- Increased through-put resulting in more releases per year (JP Morgan Chase)
- Met every milestone (25 in a row) on time, with high quality and customer satisfaction (Northrop Grumman Defense Enterprise Systems)

Examples of Impact: Schedule*

- Results shown on this slide and the following slides are from publicly available conference presentations, published papers, and individual collaborations with the SEI, and are used with permission.

- To see additional detailed CMMI results, see www.sei.cmu.edu/cmmi/results.html.

Examples of Impact: Productivity

- Improved productivity substantially, with “significantly more rigorous engineering practices” due to CMMI® (Fort Sill Fire Support Software Engineering Center)
- Improved software productivity (including reuse) from a 1992 baseline by approximately 80 percent at SWCMM® maturity level 5 In 1997 to over 140 percent at CMMI ML 5 in 2001 (Lockheed Martin Systems Integration)
- 25 percent productivity improvement in 3 years (Siemens Information Systems Ltd, India)
- Used Measurement & Analysis to realize an 11 percent increase in productivity, corresponding to $4.4M in additional value (reported under non-disclosure)

Examples of Impact: Quality

- Reduced software defects per million delivered SLOC by over 50 percent compared to defects prior to CMMI (Lockheed Martin Systems Integration)
- Reduced defect rate at CMMI ML5 approximately one third compared to performance at SW-CMM ML5 (Lockheed Martin Maritime Systems & Sensors – Undersea Systems)
- Improved defect removal before test from 50 percent to 70 percent, leaving 0.35 post release defects per KLOC (Siemens Information Systems Ltd, India)
- 44 percent defect reduction following causal analysis cycle at maturity level 2 (reported under non disclosure)

Examples of Impact: ROI

- 5:1 ROI for quality activities (Accenture)
- 13:1 ROI calculated as defects avoided per hour spent in training and defect prevention (Northrop Grumman Defense Enterprise Systems)
- Avoided $3.72M in costs due to better cost performance (Raytheon North Texas Software Engineering)
  - As the organization improved from SW-CMM level 4 to CMMI level 5
- 2:1 ROI over 3 years (Siemens Information Systems
- Ltd, India)
- 2.5:1 ROI over 1st year, with benefits amortized over less than 6 months (reported under non disclosure)

Examples of Impact

- Quality
  - Reduced software defects per million delivered SLOC by over 50 percent compared to defects prior to CMMI (Lockheed Martin Systems Integration)
- Schedule
  - Decreased average # of days late from 50 to < 10 (General Motors)
- Productivity
  - Improved software productivity from a 1992 baseline by approximately 80% at SW-CMM ML 5 in 1997 to over 140% at CMMI ML 5 in 2001 (Lockheed Martin Systems Integration)
- Overall
  - Met every milestone (25 in a row) on time, with high quality and customer satisfaction (Northrop Grumman DES)

Published Benefits

- For more detailed information about CMMI benefits, see www.sei.cmu.edu/cmmi/results.html and the SEI special report, Demonstrating the Impact and Benefits of CMMI: An Update and Preliminary Results

- Based on case studies, supplementary materials, and comprehensive literature review

- On the SEI Web site at http://www.sei.cmu.edu/publications/documents/03.reports/03sr009.html

CMMI Worldwide Adoption

- Appraisals of organizations using CMMI have been conducted in the following countries:
- Argentina, Australia, Belarus,
- Belgium, **Canada**, Chile, China,
- Columbia, Denmark, Finland, France,
- Germany, India, Israel, Japan, Korea,
- Republic of Malaysia, Philippines,
- Portugal, Russia, Singapore, Slovakia,
- South Africa, Spain, Sweden,
- Switzerland, Taiwan, Thailand, Turkey,
- United Kingdom, Vietnam, United States

Organizations Using CMMI

- The following is an abbreviated list of organizations that are 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 Dept. 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 BM Ericsson Fujitsu Hitachi Infosys KPMG Motorola NEC NRO Polaris SAIC TRW U.S. Navy Zurich Financial Services

Five Reasons to Adopt CMMI

- CMMI helps your organization to …
- 1. Improve delivery of product and service performance, cost, and schedule
- 2. Collaborate with external stakeholders and meet their expectations in day-to-day activities
- 3. Provide competitive world-class products and services
- 4. Implement an integrated enterprise business and engineering perspective
- 5. Use common, integrated, and improving processes for systems and software

Maturity Levels: How Long to Move Up?

1992 to June 2005*

Maturity Level	Median # Months
level 1 to 2	**19**
level 2 to 3	**20**
level 3 to 4	**25**
level 4 to 5	**13**

- Empirical evidence suggests that there is variability in the amount of time it takes organizations to move from one maturity level to the next using the SW-CMM.
- Early CMMI results appear to be comparable.
- * Software CMM® Appraisal Results through June 2005

CMMI Benefits

- CMMI-based process improvement benefits include:
- 1. improved schedule and budget predictability
- 2. improved cycle time
- 3. increased productivity
- 4. improved quality (as measured by defects)
- 5. increased customer satisfaction
- 6. improved employee morale
- 7. increased return on investment
- 8. decreased cost of quality

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® for Development, Version 1.2

"Improving processes for better products"

CMU/SEI-2006-TR-008
ESC-TR-2006-008

August 2006

“If You Don’t Know Where You’re Going, Any Road Will Do.”

Chinese Proverb

“If you don’t know where you are,
a map won’t help.”

Watts S. Humphrey
“Father” of the Capability Maturity Model (CMM)
Software Engineering Institute
Carnegie Mellon University

22 CMMI Process Areas
Alphabetical Order By Acronym – 1/2

- There are 22 process areas, presented here in alphabetical order by acronym:
  - Causal Analysis and Resolution (CAR)
  - Configuration Management (CM)
  - Decision Analysis and Resolution (DAR)
  - Integrated Project Management +IPPD (IPM+IPPD)
  - Measurement and Analysis (MA)
  - Organizational Innovation and Deployment (OID)
  - Organizational Process Definition +IPPD (OPD+IPPD)
  - Organizational Process Focus (OPF)
  - Organizational Process Performance (OPP)
  - Organizational Training (OT)

22 CMMI Process Areas
Alphabetical Order By Acronym – 2/2

- Product Integration (PI)
- Project Monitoring and Control (PMC)
- Project Planning (PP)
- Process and Product Quality Assurance (PPQA)
- Quantitative Project Management (QPM)
- Requirements Development (RD)
- Requirements Management (REQM)
- Risk Management (RSKM)
- Supplier Agreement Management (SAM)
- Technical Solution (TS)
- Validation (VAL)
- Verification (VER)

CMMI - Capability Levels vs. Maturity Levels

Level	*Continuous Representation* *Capability Levels*	*Staged Representation* *Maturity Levels*
Level 0	Incomplete	N/A
Level 1	Performed	Initial
Level 2	Managed	Managed
Level 3	Defined	Defined
Level 4	Quantitatively Managed	Quantitatively Managed
Level 5	Optimizing	Optimizing

Four Categories of CMMI Process Areas

- Process areas can be grouped into four categories:
  - Process Management – (PMO)
  - Project Management – (PM)
  - Engineering – (PM)
  - Support – (PMO)

- Appendix A has additional information

CMMI Process Areas
Process Management - Project Management

Process Area	*Category*	*Maturity Level*
Organizational Process Focus	Process Management	3
Organizational Process Definition +IPPD	Process Management	3
Organizational Training	Process Management	3
Organizational Process Performance	Process Management	4
Organizational Innovation and Deployment	Process Management	5
Project Planning	Project Management	2
Project Monitoring and Control	Project Management	2
Supplier Agreement Management	Project Management	2
Integrated Project Management +IPPD	Project Management	3
Risk Management	Project Management	3
Quantitative Project Management	Project Management	4

CMMI Process Areas – Engineering - Support

Process Area	*Category*	*Maturity Level*
Requirements Management	Engineering	2
Requirements Development	Engineering	3
Technical Solution	Engineering	3
Product Integration	Engineering	3
Validation	Engineering	3
Verification	Engineering	3
Measurement and Analysis	Support	2
Process and Product Quality Assurance	Support	2
Configuration Management	Support	2
Decision Analysis and Resolution	Support	3
Causal Analysis and Resolution	Support	5

CMMI Process Areas – Maturity Level 2

Process Area	*Category*	*Maturity Level*
Requirements Management	Engineering	2
Project Planning	Project Management	2
Project Monitoring and Control	Project Management	2
Supplier Agreement Management	Project Management	2
Measurement and Analysis	Support	2
Process and Product Quality Assurance	Support	2
Configuration Management	Support	2

CMMI Process Areas – Maturity Level 3

Process Area	*Category*	*Maturity Level*
Requirements Development	Engineering	3
Technical Solution	Engineering	3
Product Integration	Engineering	3
Validation	Engineering	3
Verification	Engineering	3
Organizational Process Focus	Process Management	3
Organizational Process Definition +IPPD	Process Management	3
Organizational Training	Process Management	3
Integrated Project Management +IPPD	Project Management	3
Risk Management	Project Management	3
Decision Analysis and Resolution	Support	3

CMMI Process Areas – Maturity Levels 4 & 5

Process Area	*Category*	*Maturity Level*
Organizational Process Performance	Process Management	4
Quantitative Project Management	Project Management	4
Organizational Innovation and Deployment	Process Management	5
Causal Analysis and Resolution	Support	5

CMMI Process Areas

CMMI[SM] Staged Representation			
Level	**Process Areas**		**Category**
5 Optimizing	Organizational Innovation and Deployment	OID	Process Mgt
	Causal Analysis and Resolution	CAR	Support
4 Quantitatively Managed	Organizational Process Performance	OPP	Process Mgt
	Quantitative Project Management	QPM	Project Mgt
3 Defined	Requirements Development	RD	Engineering
	Technical Solution	TS	Engineering
	Product Integration	PI	Engineering
	Verification	VER	Engineering
	Validation	VAL	Engineering
	Organizational Process Focus	OPF	Process Mgt
	Organizational Process Definition	OPD	Process Mgt
	Organizational Training	OT	Process Mgt
	Integrated Project Management	IPM	Project Mgt
	Risk Management	RSKM	Project Mgt
	Decision Analysis and Resolution	DAR	Support
	Integrated Supplier Management	ISM	Project Mgt
	Organizational Environment for Integration	OEI	Support
	Integrated Teaming	IT	Project Mgt
2 Managed	Requirements Management	REQM	Engineering
	Project Planning	PP	Project Mgt
	Project Monitoring and Control	PMC	Project Mgt
	Supplier Agreement Management	SAM	Project Mgt
	Measurement and Analysis	MA	Support
	Process and Prduct Quality Assurance	PPQA	Support
	Configuration Management	CM	Support
1 Initial			

CMMI Process Areas

Maturity Level	Focus	Process Areas
5 Optimizing	Continuous Process Improvement	Organizational Innovation and Deployment Causal Analysis and Resolution
4 Quantitatively Managed	Quantitative Management	Organizational Process Performance Quantitative Project Management
3 Defined	Process Standardization	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Integrated Supplier Management Integrated Teaming Decision Analysis and Resolution Organizational Environment for Integration
2 Managed	Basic Project Management	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Initial		

"70 per cent of all problems on technical projects are communication problems"

Watts S. Humphrey

“Father” of the Capability Maturity Model (CMM)

Software Engineering Institute

Carnegie Mellon University

Generic Practices and Practices

Common Feature

Institutionalization

Institutionalization

- Institutionalization is the ingrained way of doing business that an organization follows routinely as part of its corporate culture.

- The generic goals and practices enable the organization to institutionalize best practices.

- A managed process is institutionalized by performing all the generic practices.

Common Features – 1/3

- Common features are predefined attributes that group generic practices into categories.
- Common features are model components that are not rated in any way.
- They are only groupings that provide a way to present the generic practices.
- There are four common features used in CMMI models with a staged representation:
  - Commitment to Perform
  - Ability to Perform
  - Directing Implementation
  - Verifying Implementation.

Common Features – 2/3

- Commitment to Perform (CO)
  - groups the generic practices related to creating policies and securing sponsorship.

- Ability to Perform (AB)
  - groups the generic practices related to ensuring that the project and/or organization has the resources it needs.

Common Features – 2/3

- Directing Implementation (DI)
  - groups the generic practices related to managing the performance of the process, managing the integrity of its work products, and involving relevant stakeholders.

- Verifying Implementation (VE)
  - groups the generic practices related to review by higher level management and objective evaluation of conformance to process descriptions, procedures, and standards.

Commitment to Perform

- Establish and maintain an organizational policy for planning and performing the process.

Ability to Perform

- Establish and maintain the plan for performing the process.
- Provide adequate resources for performing the process, developing the work products, and providing the services of the process.
- Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process.
- Train the people performing or supporting the process as needed.
- Establish and maintain the description of a defined process.

Directing Implementation

- Place designated work products of the process under appropriate levels of configuration management.
- Identify and involve the relevant stakeholders as planned.
- Monitor and control the process against the plan for performing the process and take appropriate corrective action.
- Collect work products, measures, measurement results, and improvement information derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets.

Verifying Implementation

- Objectively evaluate adherence of the process against its process description, standards, and procedures, and address noncompliance.

- Review the activities, status, and results of the process with higher level management and resolve issues.

CMMI Generic Practices

Table 1: Generic Practices and Related Process Areas

Generic Practice	Process Area that enables (or is partly subsumed by) the generic practice
GP 2.1 Establish an Organizational Policy	
GP 2.2 Plan the Process	Enabled by Project Planning
GP 2.3 Provide Resources	Enabled by Project Planning
GP 2.4 Assign Responsibility	Enabled by Project Planning
GP 2.5 Train People	Enabled by Organizational Training
GP 2.6 Manage Configurations	Enabled by Configuration Management
GP 2.7 Identify and Involve Relevant Stakeholders	Enabled by Integrated Project Management
GP 2.8 Monitor and Control the Process	Enabled by Project Monitoring and Control
GP 2.9 Objectively Evaluate Adherence	Enabled by Process and Product Quality Assurance
GP 2.10 Review Status with Higher Level Management	Enabled by Project Monitoring and Control
GP 3.1 Establish a Defined Process	Enabled by Integrated Project Management
GP 3.2 Collect Improvement Information	Subsumes part of Integrated Project Management
GP 4.1 Establish Quantitative Objectives for the Process	Enabled by Organization Process Performance
GP 4.2 Stabilize Subprocess Performance	Subsumes part of Quantitative Project Management
GP 5.1 Ensure Continuous Process Improvement	Enabled by and subsumes part of Organizational Innovation and Deployment
GP 5.2 Correct Root Causes of Problems	Subsumes part of Causal Analysis and Resolution

Are Your Organization's Processes Balanced ?

"Demystifying the SEI CMMI "
Q & A
The End

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Appendix A:
Four Categories of CMMI Process Areas

Process areas can be grouped into four categories:

Process Management

Project Management

Engineering

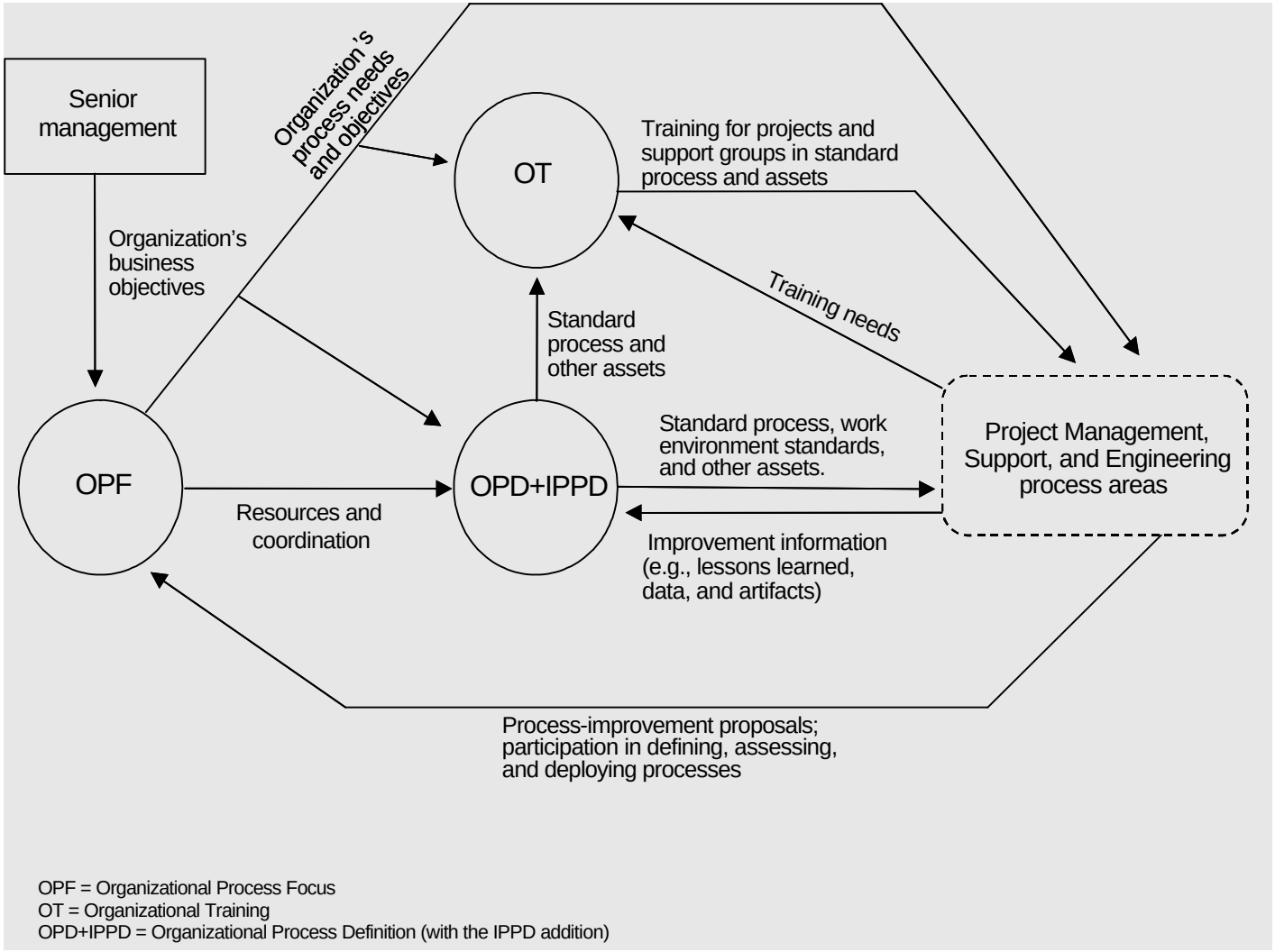
Support

Process Management Process Areas

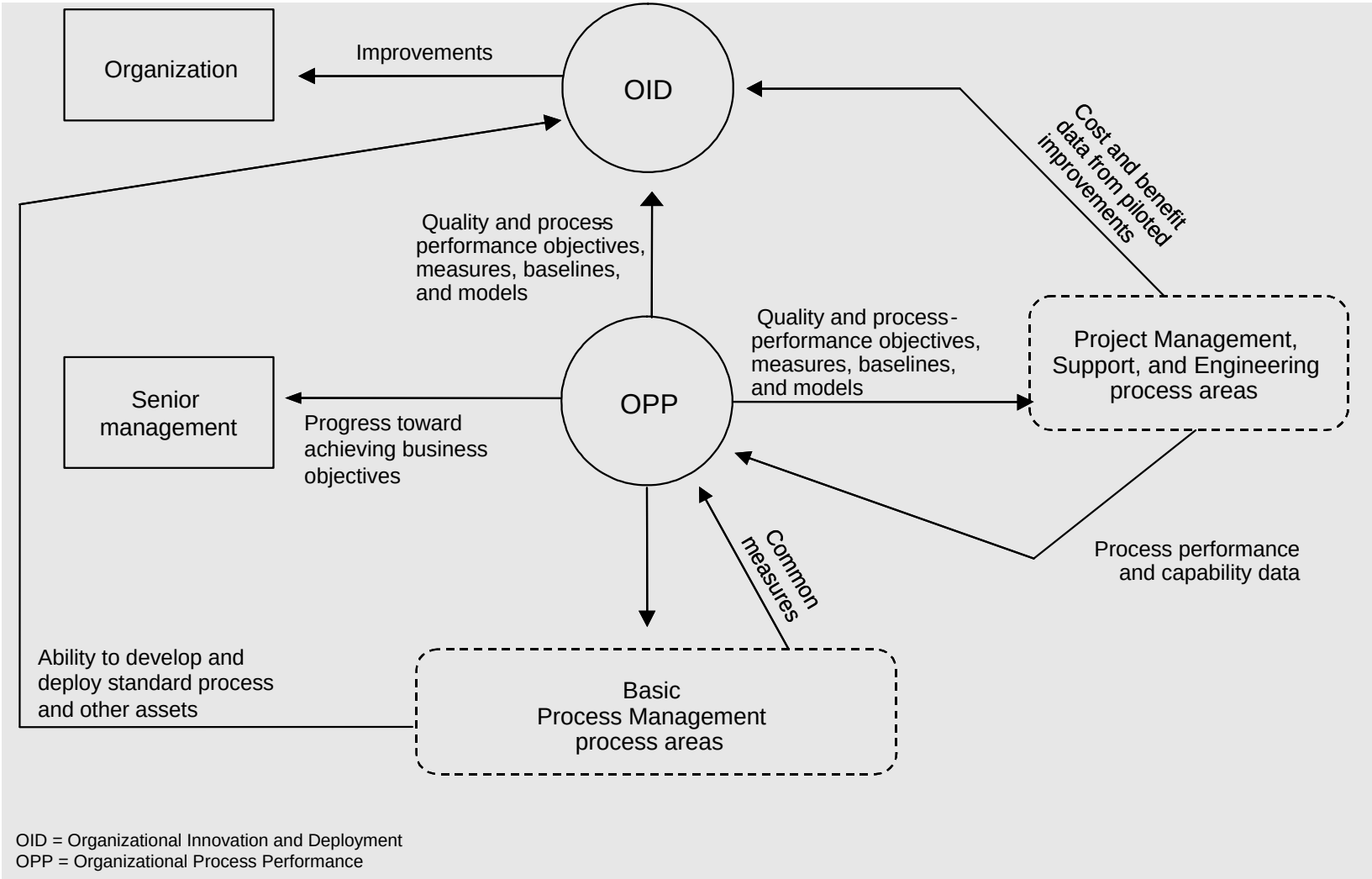
- Process Management process areas contain the cross-project activities related to defining, planning, deploying, implementing, monitoring, controlling, appraising, measuring, and improving processes.

- The Process Management process areas of CMMI are as follows:
  - Organizational Process Focus
  - Organizational Process Definition +IPPD
  - Organizational Training
  - Organizational Process Performance
  - Organizational Innovation and Deployment

Basic Process Management Process Areas



Advanced Process Management Process Areas

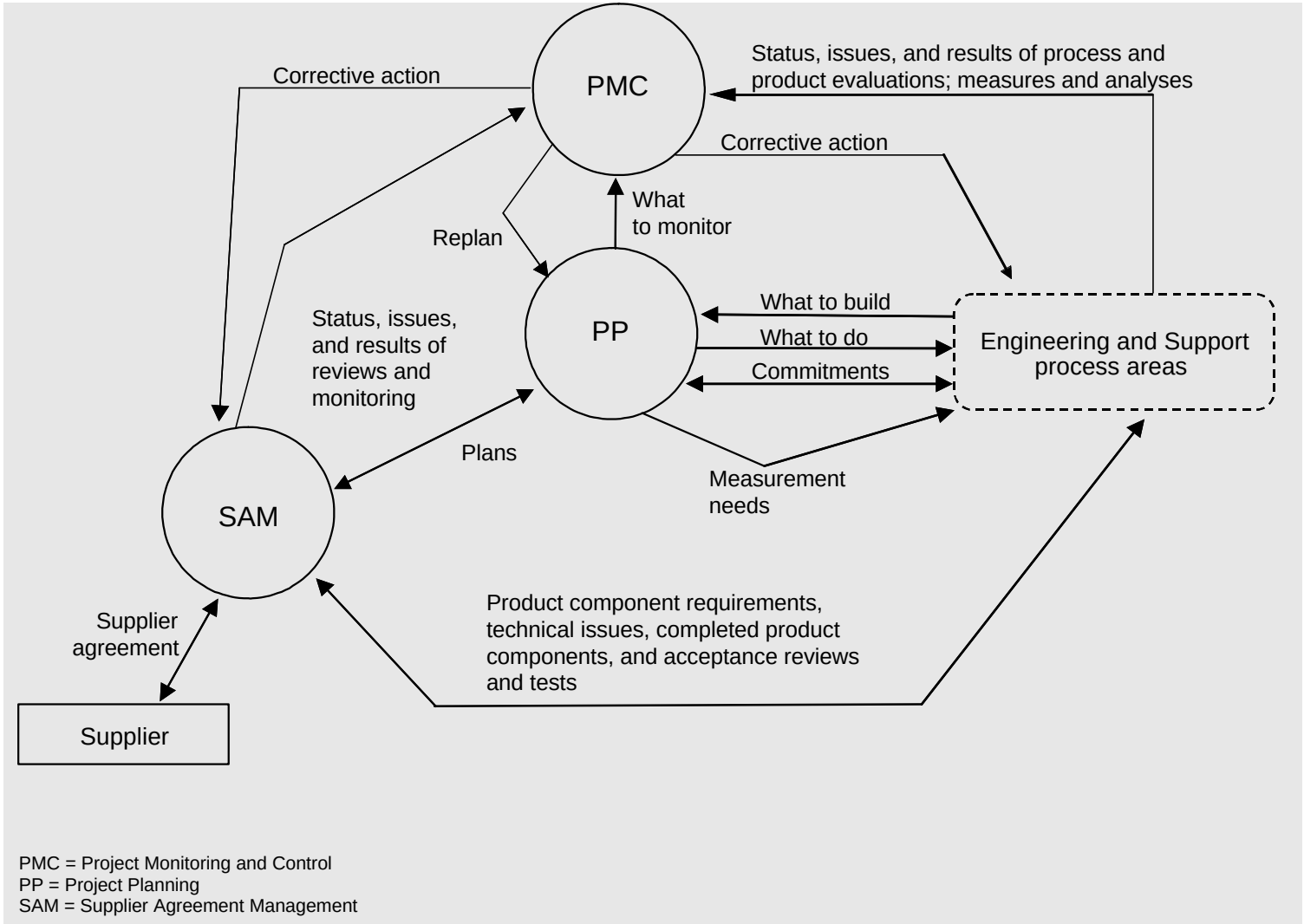


Project Management Process Areas

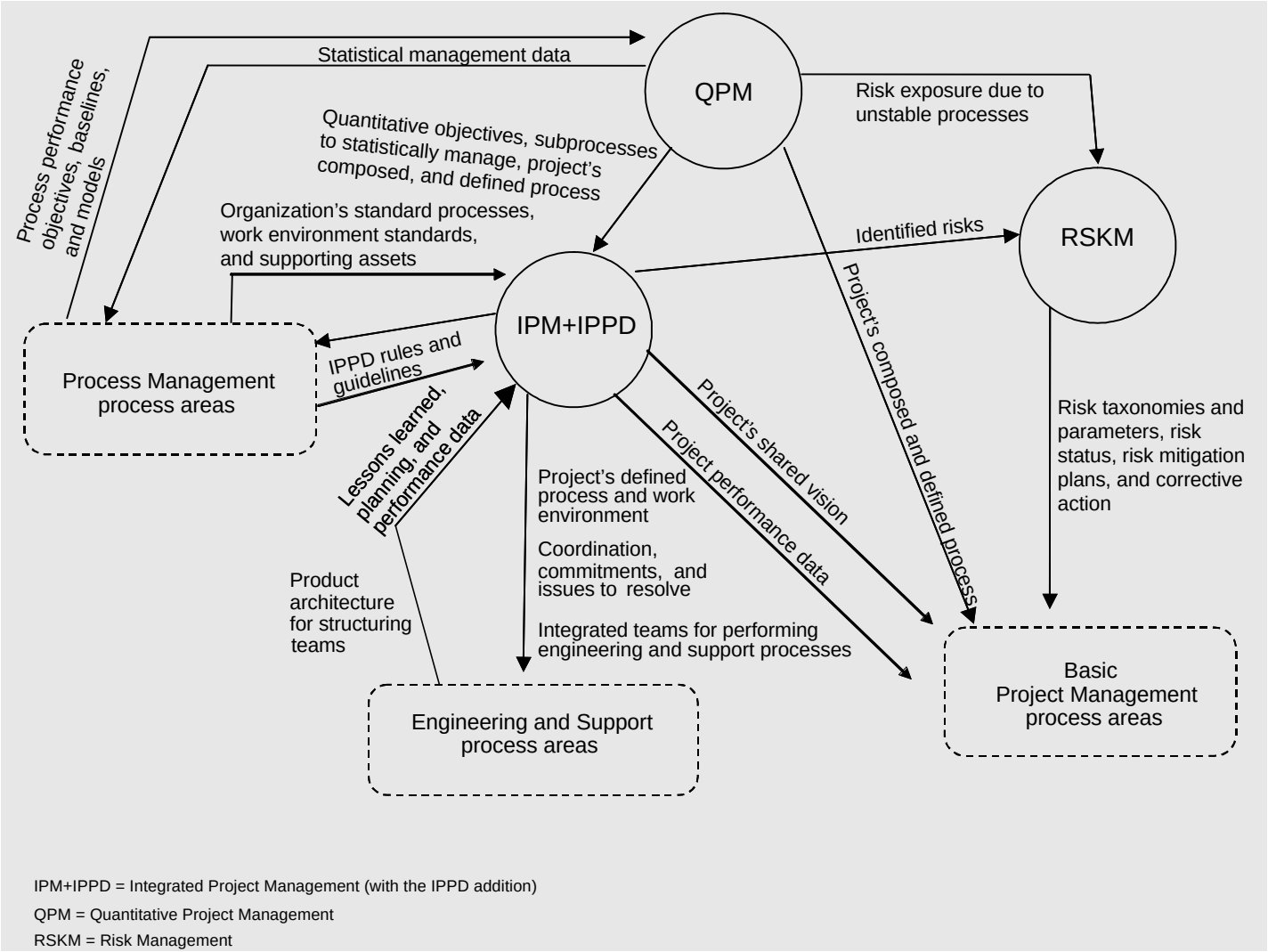
- Project Management process areas cover the project management activities related to planning, monitoring, and controlling the project.

- The Project Management process areas of CMMI are as follows:
  - Project Planning
  - Project Monitoring and Control
  - Supplier Agreement Management
  - Integrated Project Management +IPPD
  - Risk Management
  - Quantitative Project Management

Basic Project Management Process Areas



Advanced Project Management Process Areas



Marko Wolf-Pany, P.Eng., PMP
Process Improvement Specialist – Project Management Consultant

Engineering Process Areas – 1/3

- Engineering process areas cover the development and maintenance activities that are shared across engineering disciplines.
- The Engineering process areas were written using general engineering terminology so that any technical discipline involved in the product development process (e.g., software engineering or mechanical engineering) can use them for process improvement.

Engineering Process Areas – 2/3

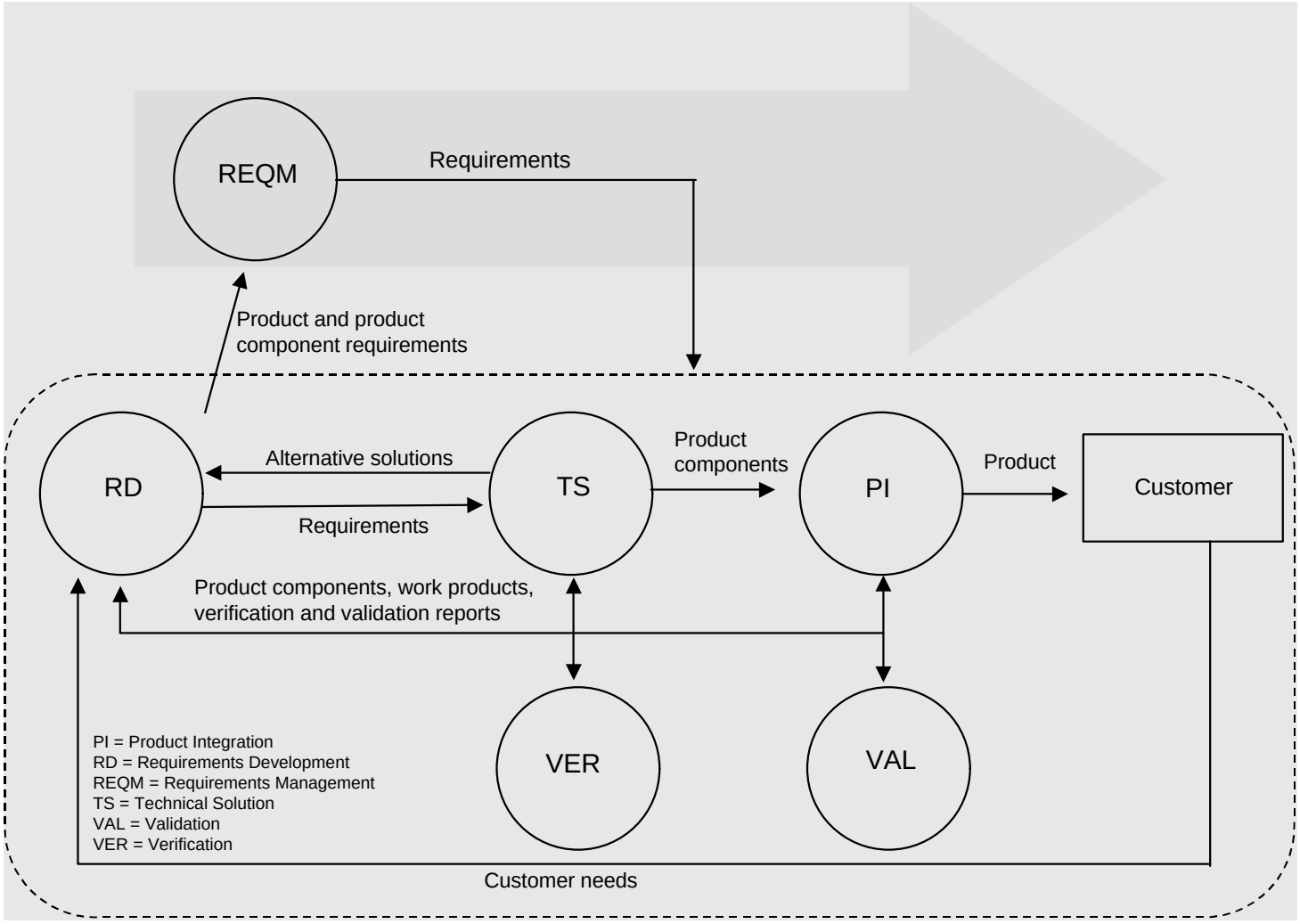
- The Engineering process areas also integrate the processes associated with different engineering disciplines into a single product development process, supporting a product-oriented process improvement strategy.
- Such a strategy targets essential business objectives rather than specific technical disciplines.
- This approach to processes effectively avoids the tendency toward an organizational “stovepipe” mentality.

Engineering Process Areas – 3/3

- The Engineering process areas apply to the development of any product or service in the development domain (e.g., software products, hardware products, services, or processes).

- The Engineering process areas of CMMI are as follows:
  - Requirements Development
  - Requirements Management
  - Technical Solution
  - Product Integration
  - Verification
  - Validation

Engineering Process Areas



Support Process Areas – 1/2

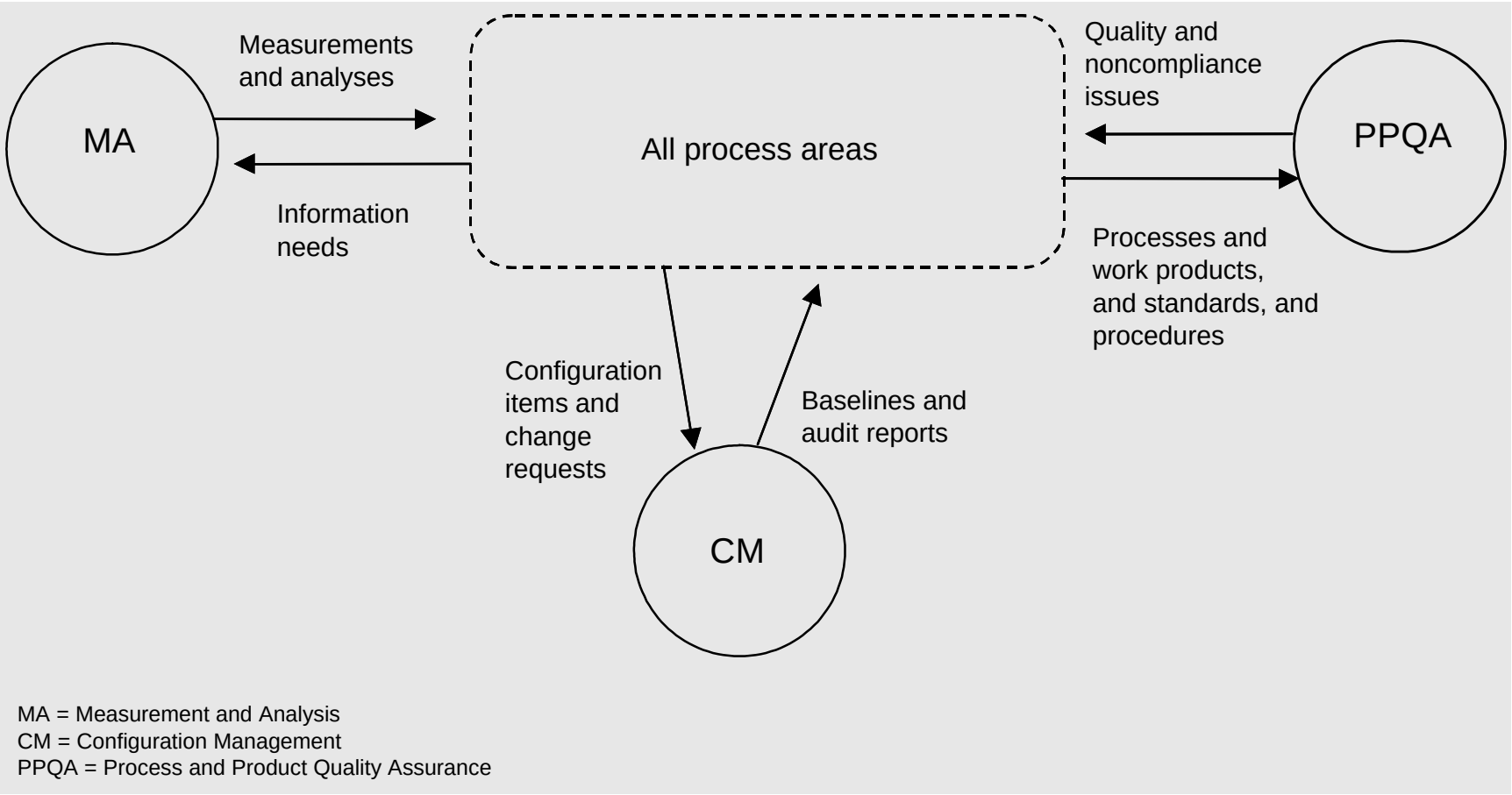
- Support process areas cover the activities that support product development and maintenance.
- The Support process areas address processes that are used in the context of performing other processes.
- In general, the Support process areas address processes that are targeted toward the project and may address processes that apply more generally to the organization.

Support Process Areas – 2/2

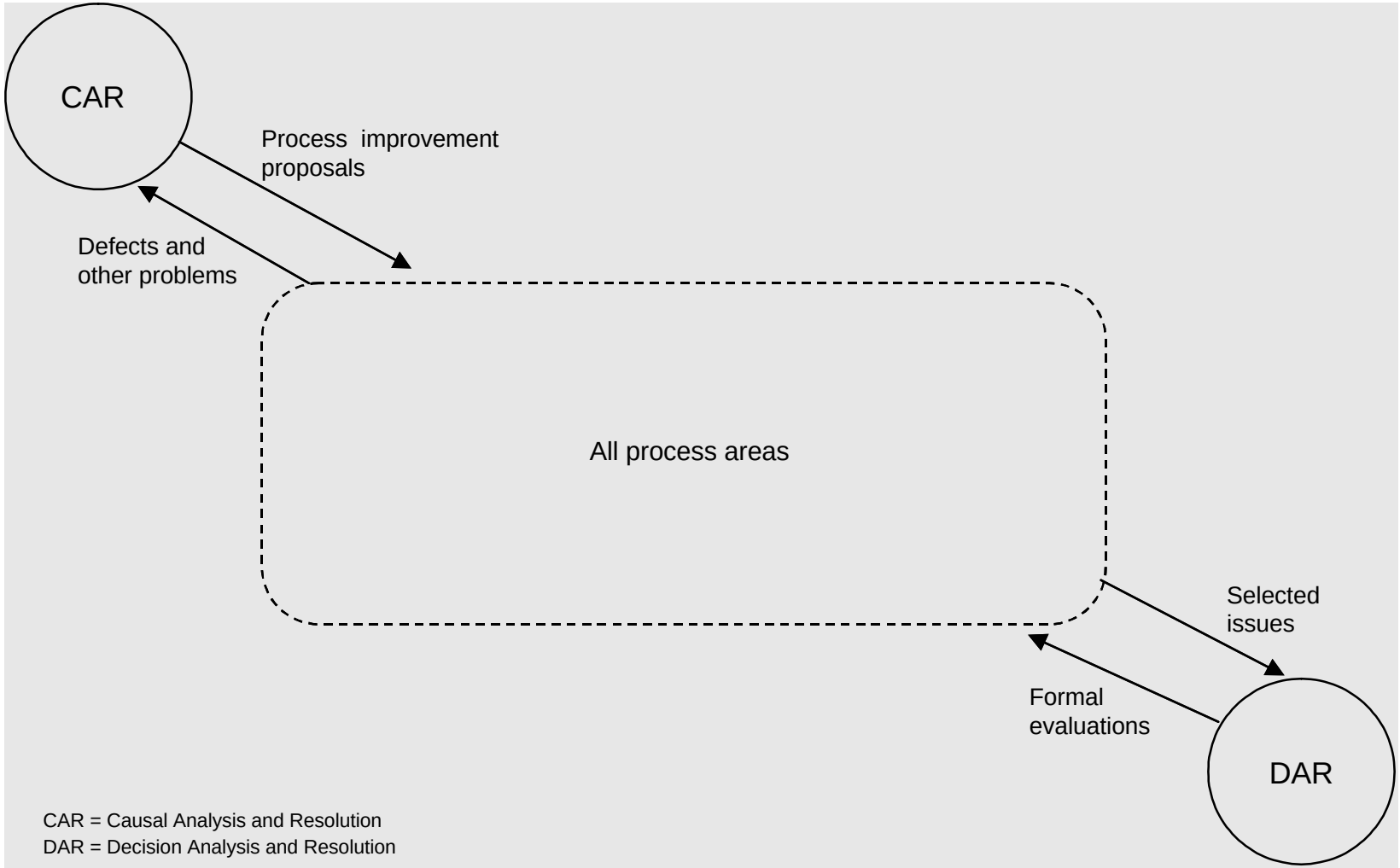
- For example, Process and Product Quality Assurance can be used with all the process areas to provide an objective evaluation of the processes and work products described in all the process areas.

- The Support process areas of CMMI are as follows:
  - Configuration Management
  - Process and Product Quality Assurance
  - Measurement and Analysis
  - Decision Analysis and Resolution
  - Causal Analysis and Resolution

Basic Support Process Areas



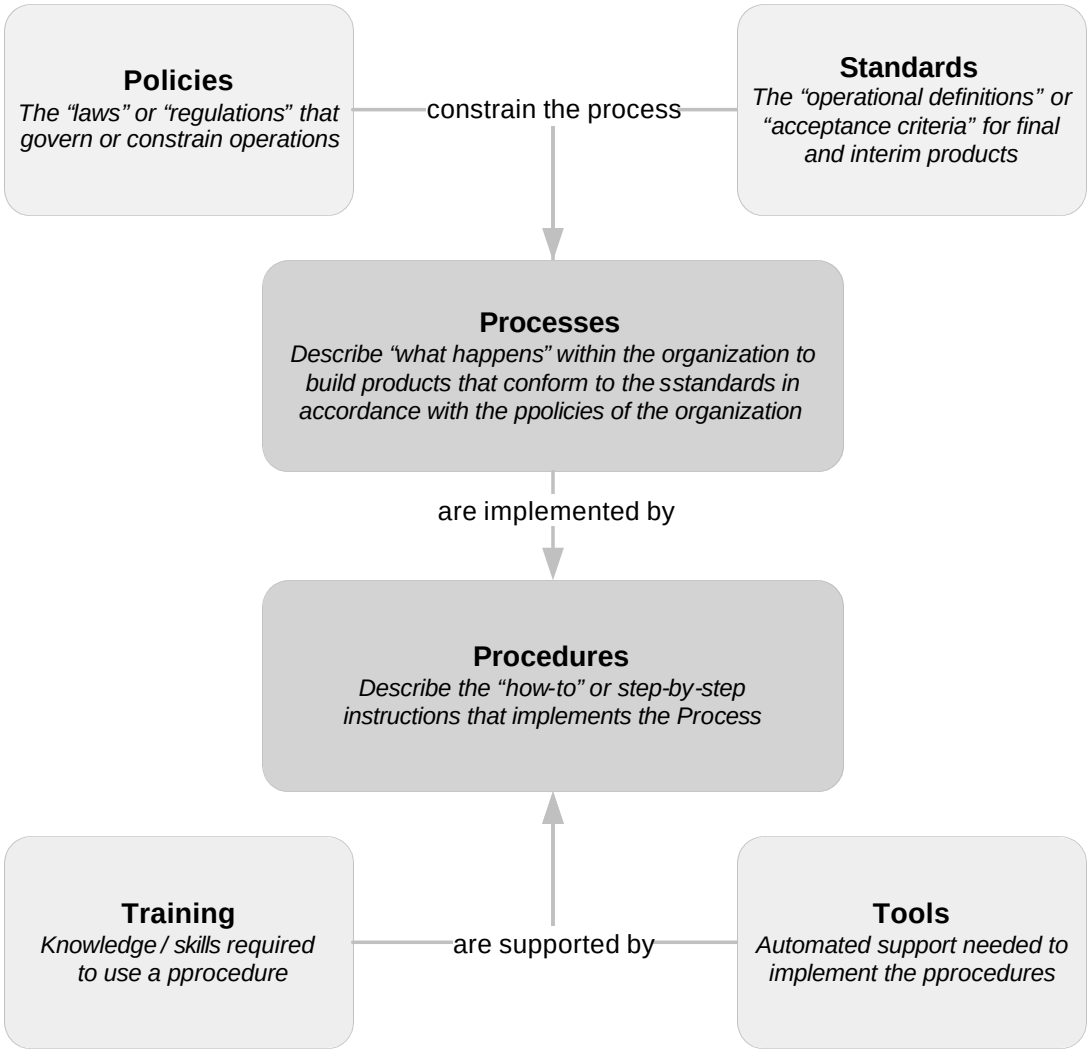
Advanced Support Process Areas



Appendix B:
The Operational Framework

The operational framework describes the operational elements that govern organizational software development.

The Operational Framework – 2/3



The Operational Framework – 3/3

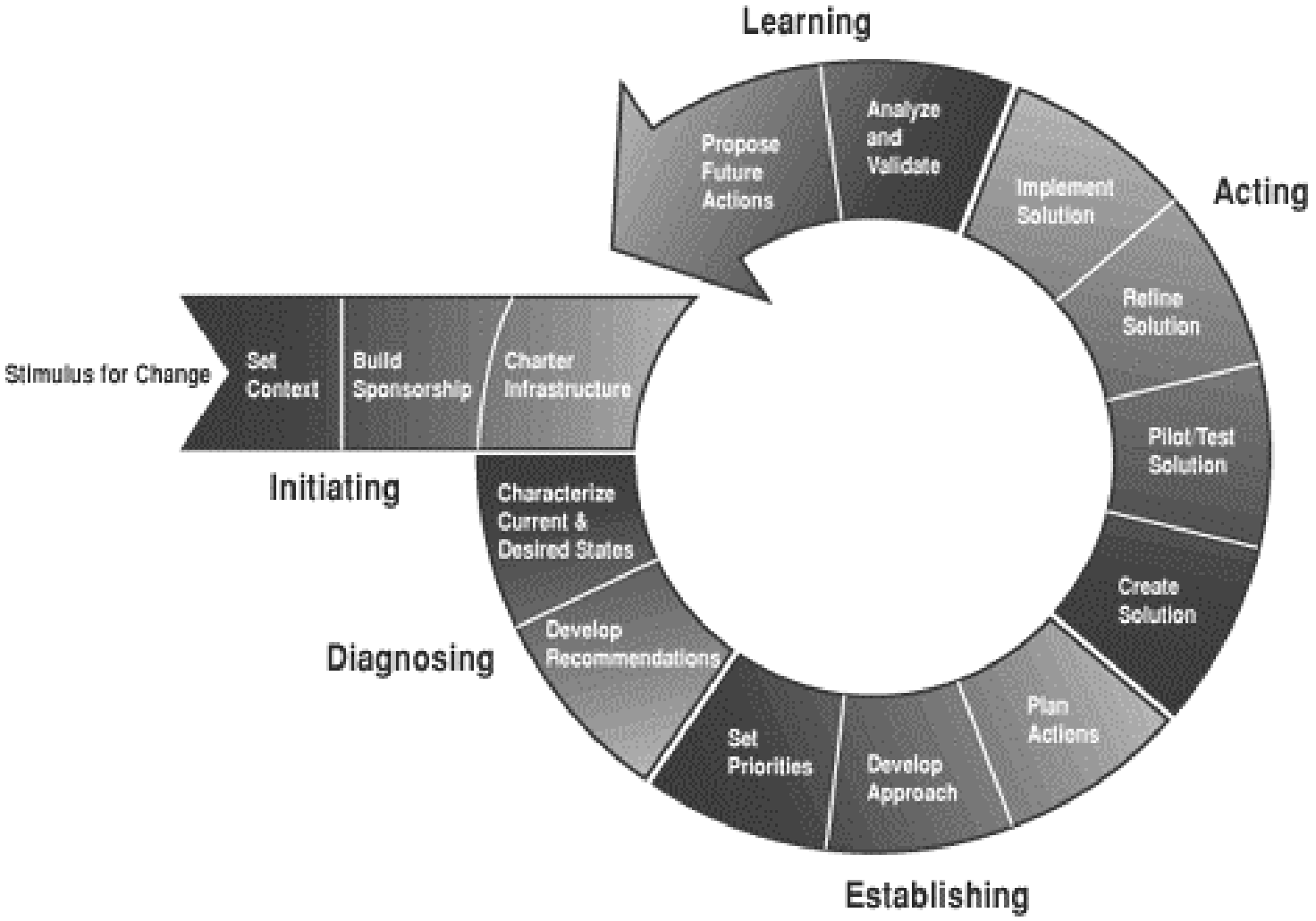
- Policies
  - Organizational policies dictate the rules that govern operations. A policy statement usually is used to enforce the use of organizational processes. A policy statement, therefore, constrains organizational processes by identifying required or acceptable processes, or ways of doing work.
- Processes
  - A process is what happens in the organization to build products. Processes are constrained by organizational policies and standards in that they must specify ways to develop products that conform to organizational standards, in accordance with organizational policies.
- Training
  - Training addresses the knowledge and skills required to execute a process or use a procedure. Training is used to support the use of processes and procedures.
- Standards
  - Standards are the operational definitions of final or interim organizational work products. Standards constrain organizational processes by setting acceptance criteria on the output of those processes.
- Procedures
  - Procedures are the step-by-step instructions for implementing a process or a portion of a process. Procedural information focuses on how to perform a certain task identified in the process. Processes are, therefore, implemented by specific procedures.
- Tools
  - Tools are any automated support needed to implement a procedure. Tools, like training, are used to support the use of processes and procedures.

Appendix C:
The IDEAL Model

The IDEAL^{SM} model is an organizational improvement model that serves as a roadmap for initiating, planning, and implementing improvement actions.

The IDEAL model is named for the five phases it describes: initiating, diagnosing, establishing, acting, and learning.

The IDEAL Model



Appendix D
The SEI Capability Maturity Models

- Capability Maturity Model® for Software (SW-CMM®)
- CMMI-SE/SW/IPPD, Version 1.1, January 11, 2002
- CMMI-SE/SW, Version 1.1, January 11, 2002
- CMMI-SE/SW/IPPD/SS, Version 1.1, March 1, 2002
- CMMI-SW, Version 1.1, August 19, 2002
- CMMI Acquisition Module, Version 1.1, May 2005
- Software Acquisition Capability Maturity Model®, (SA-CMM®), Version 1.03, March 2002
- People Capability Maturity Model® (P-CMM®), Version 2, July 2001
- The Personal Software Process SM (PSP SM), November 2000
- Team Software Process SM (TSP SM)

Capability Maturity Model® for Software (SW-CMM®)

- The Capability Maturity Model for Software (also known as the CMM and SW-CMM) has been a model used by many organizations to identify best practices useful in helping them increase the maturity of their processes

- In 2000, the SW-CMM was upgraded to CMMI® (Capability Maturity Model Integration)

- The SEI no longer maintains the SW-CMM model, its associated appraisal methods, or training materials, nor does the SEI offer SW-CMM training

CMMI-SE/SW/IPPD V1.1

- CMMI-SE/SW/IPPD V1.1 contains material that integrates systems engineering, software engineering, and Integrated Product and Process Development (IPPD), and is an update to CMMI-SE/SW/IPPD V1.02

- When compared to CMMI-SE/SW, CMMI-SE/SW/IPPD has the following differences:
  - two additional process areas covering IPPD: Organizational Environment for Integration (OEI) and Integrated Teaming (IT)
  - an enhanced version of the Integrated Project Management (IPM) process area that contains IPPD-related practices
  - amplifications in some of the SE/SW process areas that address IPPD-specific concerns

CMMI-SE/SW V1.1

- CMMI-SE/SW V1.1 contains material that integrates systems engineering and software engineering, and is an update to CMMI-SE/SW V1.02.

CMMI® V1.1 Model with Supplier Sourcing – 1/2

- The addition of supplier sourcing as a discipline included in CMMI models has resulted in the release of a CMMI model (CMMI-SE/SW/IPPD/SS, Version 1.1) that addresses all of the currently integrated disciplines:
  - Systems Engineering (SE)
  - Software Engineering (SW)
  - Integrated Product and Process Development (IPPD)
  - Supplier Sourcing

CMMI® V1.1 Model with Supplier Sourcing – 2/2

- When compared to CMMI-SE/SW and CMMI-SE/SW/IPPD, CMMI-SE/SW/IPPD/SS has the following differences:
  - One additional process area covering supplier sourcing best practices:
    - Integrated Supplier Management (ISM)
  - Amplifications in some SE/SW and SE/SW/IPPD process areas that address concerns specific to supplier sourcing
  - Informative material throughout the model, including chapters 1-6 and the appendices

CMMI® SW Version 1.1

- This model, containing the software engineering discipline, is generally the same as the CMMI-SE/SW Version 1.1 model minus the systems engineering amplifications

- Although a vast majority of the material is the same, this model may better suit the needs of software-only organizations

CMMI® Acquisition Module (CMMI-AM)

- The CMMI Steering Group and the Software Engineering Institute announce that the CMMI Acquisition Module (CMMI-AM) Version 1.0 has been released and is available for use by Department of Defense and federal government acquisition offices

- Based on CMMI-SE/SW/IPPD/SS, the Acquisition Module is a condensed form of CMMI designed to enable individual process improvement efforts within government program offices

- CMMI-AM will also facilitate software acquisition process as now required by law

Software Acquisition Capability Maturity Model (SA-CMM) – 1/2

- The SA-CMM is a capability maturity model for organizations that acquire or procure software-intensive systems

- It is used to assess their process maturity and help improve their software acquisition process

Software Acquisition Capability Maturity Model (SA-CMM) – 2/2

- The SA-CMM provides acquisition organizations with guidance on how to gain control of their software acquisition processes and helps them to
  - enhance understanding of software life-cycle activities in relation to system acquisitions
  - benchmark the maturity level of the organization/s acquisition "Demystifying the SEI CMMI" process through assessment
  - improve the acquisition processes for software intensive systems
  - set senior management goals for improvement
  - enable prediction of potential acquisition process performance

People Capability Maturity Model® (P-CMM®)

- The People Capability Maturity Model (People CMM) is an organizational change model designed on the premise that improved workforce practices will not survive unless an organization's behaviour changes to support them

- It was developed to guide systems and software organizations in attracting, motivating, and retaining talented technical staff

People Capability Maturity Model® (P-CMM®)

- The practices in the model help an organization develop the workforce required to execute business strategies, characterize the maturity of workforce practices, set priorities for improving workforce capability, integrate improvements in process and workforce capability, and become an employer of choice

- The primary objective of the People CMM is to improve the capability of the entire workforce

- This can be defined as the level of knowledge, skills, and process abilities available for performing an organization's current and future business activities

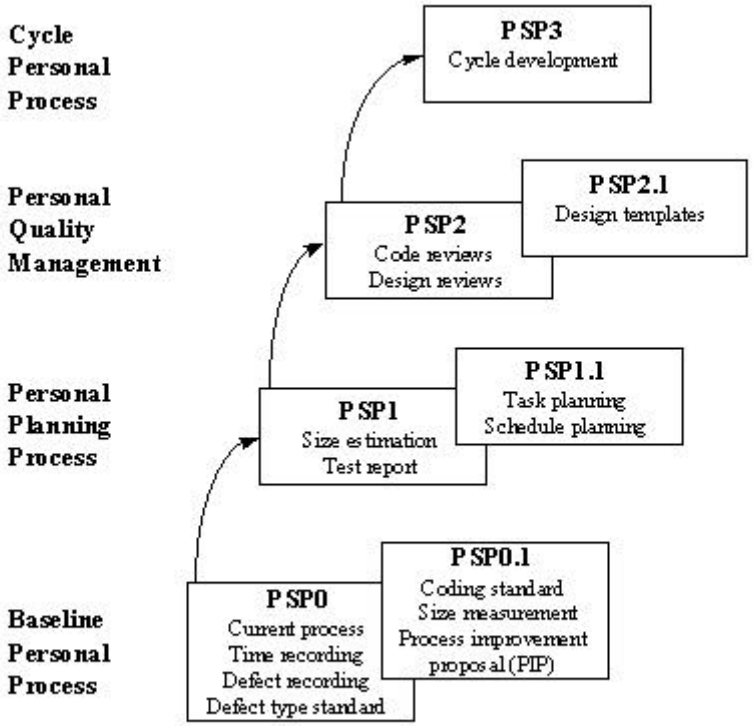
Personal Software Process (PSP)

- The Personal Software Process (PSP) shows engineers how to
  - manage the quality of their projects
  - make commitments they can meet
  - improve estimating and planning
  - reduce defects in their products

Team Software Process (TSP)

- The Team Software Process (TSP), along with the Personal Software Process, helps the high-performance engineer to
  - ensure quality software products
  - create secure software products
  - improve process management in an organization

Personal Software Process (PSP)



What are your Organization's Process Improvement Needs ?