SEIPartner

Transdyne Corporation
CMMI Implementations in Small & Medium Organizations
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CMMI[SM] Instructional Challenges for Systems Engineers in Small and Medium Organizations

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Agenda: CMMI[SM] Instructional Challenges for Systems Engineers in Small Settings

- SE Process Improvement Background
- Overview of Process Areas and Representations
- SE Services Paradigm: SE Vee for Small to Medium Organizations
- SE Services Background Descriptions and Examples of Project Documents by Process Category
  - Process Management
  - Project Management
  - Engineering
  - Support
- Comparison of CMMI Implementation Success Factors and Organization Size

Process Improvement Background: Circa 1910

Pre CMMI History and Influences

- The history of process improvement has origins back to the turn of the century during the American industrial age. The establishment of assembly lines by Henry Ford caused a demand for skilled workers.
- The early assembly lines were plagued with quality problems which were not discovered usually until the final part was inserted into the Model T Ford.
- The scrap pile was substantial, which increased the cost to the consumer.
- An additional quality problem was detected in the manufacturing of gun casings in WWI that exploded upon firing and caused casualties.
- Faced with these and other manufacturing quality control challenges, early pioneers of process improvement, such as Joseph Juran, Walter Shewhart, W. Edwards Deming, Phil Crosby and later workers, such as Watts Humphrey of the Software Engineering Institute decided to focus on the process and not just inspecting the products.

CMMI v1.2: Process Improvement Model Heritage

Key Process Model	Timeline
S/W CMM	1995
S/W CMM v2.0	Never released
System Engineering (SE) CMM	**1995**
Integrated Product Development (IPD) CMM	1997
Electronic Industries Association (EIA) 731 (Systems Engineering)	**1998**
CMMI v1.1	**March, 2002**
CMMI v1.2	**August, 2006**

- The heritage of CMMI v1.2 comes from numerous ISO, IEEE, EIA and SEI models.

- The CMMI is an integrated model from EIA 731, S/W Capability Maturity Model (CMM) v2.0 and Integrated Product Development Capability Maturity Model.

Note of Special Importance: The Usefulness of Models

"All models are wrong, but some are useful."

George Box
(Quality and Statistics Engineer)

- **A CMMI model is not a process.**
- **A CMMI model describes the characteristics of effective processes.**

CMMI v1.2 Benefits for Small – Medium SE Services and Development Organizations

Small – Medium Organizations	Benefits
 	The CMMI model is a structured set of good management practices collected from practitioners across private industry and government organizations.
   	Implementation of CMMI model assists organizations by providing processes to: 1. Understand the current organizational maturity and process capabilities 2. Improve current capabilities to achieve business performance goals, such as performance and quality 3. Plan and implement improvements

Process Improvement Paradigm: Balancing Resources and SE Services Business Case

Process Performance Goals

Budget

Business Case

Schedule estimation
Requirements volatility
Customer satisfaction
In-time technical expertise

7 - 10 technical
staff members
Level of effort staffing
Co-located at customer
facilities

Available resources

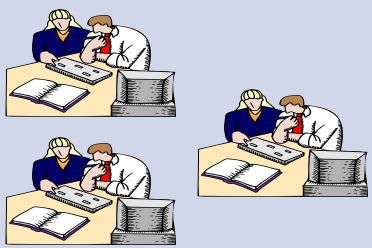
Applications

Technical Environment

Low labor and overhead
Little formal process
improvement background

SE services projects
Cycle time: 1 -6 months

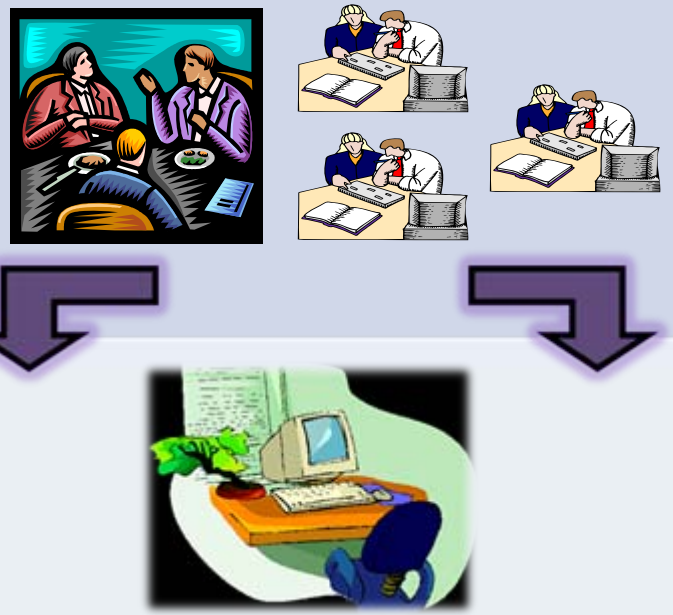
SE Services Perspective: Overview of CMMI v1.2 Process Areas (PAs)

Process Area	Benefits
1. Function  	Process Area is a cluster of related practices in an area that, when implemented collectively, satisfy a set of goals considered important for making improvement in that area. The PAs are used as building blocks to construct a foundation for improving process performance.
2. Purpose 	These practices provide organizations a set of proven management tools that are non-prescriptive (never a set of implementation practices).
3. Implementation  	Each SE services organization should determine how to implement these practices within their organizations always from a pragmatic, **"what makes sense"** perspective.

Avoiding Confusion on the Two Model Representations

The **same** 22 Process Areas are arranged in 2 different ways.

Continuous and Staged Representations



The continuous and staged representations provide two views into the **SAME** data base of information, the 22 CMMI v1.2 Process Areas.

Comparison of Continuous and Staged Representations

	Continuous		Staged		Both together
implementation flexibility	☑				☑
Maturity Levels			☑		☑
Capability Levels	☑				☑
satisfy the business goals	☑		☑		☑
provides layers in process improvement	☑		☑		☑
pre-defined sets of process areas			☑		☑
Use SCAMPI appraisal methods	☑		☑		☑
Process Areas in Process Categories	☑				☑
Process Areas in Maturity Levels			☑		☑
Obtain a benchmark			☑		☑

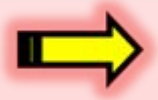
SE Services Paradigm: Participation in the SE Vee Activities for Small to Medium Organizations

Types of Roles	Small – Medium SE Services Organizations
	• Support tasks in parts of the Vee • Function as part of a larger team • Provide specialized technical expertise (on-site presence)

Context for SE Services Background Descriptions and Project Examples

	**The samples of SE services background descriptions and examples of project documents are more applicable to small and medium organizations than larger corporations.**
	The small to medium SE services organizations often function as team members that supply expertise in specialized technical domains or provide on-site technical support, such as in analysis, verification and validation tasks.
	The SE services background descriptions and examples of project documents are for the Process Areas in Maturity Level 3, excluding IPPD.

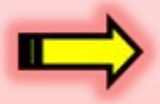
SE Services Background Descriptions and Examples
Process Category: Process Management

Process Category	Process Areas
Process Management 	**Organizational Process Focus** **Organizational Process Definition + IPPD** **Organizational Training** Organizational Process Performance Organizational Innovation and Deployment
Project Management	Project Planning Project Monitoring and Control Supplier Agreement Management Integrated Project Management + IPPD Risk Management Quantitative Project Management
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Causal Analysis and Resolution Decision Analysis and Resolution

Process Category: Process Management

SE Services Background	Process Area	Examples of Project Documents
SE services practitioners rarely participate in setting up formal process improvement organizations, documenting processes and defining process performance measurements.	Organizational Process Focus (OPF)	Documentation of participation in formal appraisals (with the exception of ISO audits) or EIA 731 are uncommon in these environments. Organizational business plans may provide documentation of process performance goals, such as customer satisfaction or improvements in schedule estimation.
SE services practitioners often use work aids, such as templates, as a guide to scheduling tasks in their projects.	Organizational Process Definition (OPD)	Templates often are used to document processes for small – medium SE services organizations. These templates are often used to plan and collect performance measurements, such as delivery schedules, hours expended, action items and review attendance.
SE service practitioners value organizations that provide training to keep technical skills current.	Organizational Training (OT)	EMAILs or announcements of existing “brown bag” sessions or presentations by invited technology advocates.

SE Services Background Descriptions and Examples
Process Category: Project Management

Process Category	Process Areas
Process Management	Organizational Process Focus Organizational Process Definition + IPPD Organizational Training Organizational Process Performance Organizational Innovation and Deployment
Project Management 	**Project Planning** **Project Monitoring and Control** **Supplier Agreement Management** **Integrated Project Management** + IPPD **Risk Management** Quantitative Project Management
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Causal Analysis and Resolution Decision Analysis and Resolution

Process Category: Project Management

SE Services Background	Process Area	Examples of Project Documents
SE services managers usually are familiar with the activities in these PAs, with the exception of formal risk management. **SE services managers and practitioners need to accurately estimate schedules, including adequate preparation time for technical reports and review packages.**	Project Planning (PP)	Project planning information if often found in the management sections of proposals and usually contains: 1. Estimation of LOE staffing and project schedules. 2. Risk identification either to the cost or schedule baselines as opposed to technical risks. 3. Planning for specialized technical knowledge or staff willing to relocate 4. Planning for management of technical reports
Action item tracking is a key project management task as the majority of the action items often directly impact the customer	Project Monitoring & Control (PMC)	Progress reports and technical review packages often document tracking and resolution of customer sensitive technical issues.

Process Category: Project Management (continued)

SE Services Background	Process Area	Examples of Project Documents
The engineers interact with the technical points of contact of suppliers, frequently as team members. Managers are tasked with supplier cost and schedule management and obtain technical performance status from engineers.	Supplier Agreement Management (SAM)	Progress reports showing status of technical performance and acceptance reports documenting delivery hardware or software
Identified risks to SE services organization typically are assessed to the cost and schedule baselines. Technical risk assessment is appropriate if organization is providing System Engineering and Technical Analysis oversight for the customer.	Risk Management (RSKM)	Progress report or technical review packages showing risk evaluations, using appropriate classification categories.
SE organizations usually do not have extensive documented processes unless provided by team member or customer. Standard work environment may be determined by the contract.	Integrated Project Management (IPM)	Technical review packages or progress reports using a customer or team member provided templates.

SE Services Background Descriptions and Examples
Process Category: Engineering

Process Category	Process Areas
Process Management	Organizational Process Focus Organizational Process Definition + IPPD Organizational Training Organizational Process Performance Organizational Innovation and Deployment
Project Management	Project Planning Project Monitoring and Control Supplier Agreement Management Integrated Project Management + IPPD Risk Management Quantitative Project Management
Engineering 	**Requirements Management** **Requirements Development** **Technical Solution** **Product Integration** **Verification** **Validation**
Support	Configuration Management Process and Product Quality Assurance Measurement and Analysis Causal Analysis and Resolution Decision Analysis and Resolution

Process Category: Engineering

SE Services Background	Process Area	Examples of Project Documents
SE services managers and engineers usually are directly involved with customers in developing technical performance requirements. As a team member, the engineers are involved in defining operational concepts and performing analysis to balance technical performance, cost and schedule.	Requirements Development (RD)	Visit reports and minutes of technical meetings with customer technical interchanges
SE services managers and engineers often serve as members of change control boards and provide significant contributions to tracking inconsistencies and defects to manage requirements changes.	Requirements Management (REQM)	Technical progress reports containing information describing inconsistencies or detected defects in requirements. Minutes of configuration control boards document recommendations and formal changes.

Process Category: Engineering (continued)

SE Services Background	Process Area	Examples of Project Documents
SE services projects are usually focused on providing technical analysis of system functions in their specialized domains. While providing technical support for customers, their analysis is limited to these specific functions.	Technical Solution (TS)	Visit reports and minutes of technical meetings with customer technical interchanges. Progress reports often provide excellent examples of engineers participation in providing technical performance analysis.
SE services organizations are often tasked with specific product integration activities, such as conducting readiness reviews or providing on-site support at the integration facility.	Product Integration (PI)	Technical progress reports containing information describing integration status as well as generated action items.

Process Category: Engineering (continued)

SE Services Background	Process Area	Examples of Project Documents
SE services engineers perform verification of requirements and designs in their specialized domains. While providing verification resources for customers, their testing and analysis is limited to the specific system functions.	Verification (VER)	Visit reports and minutes of technical meetings with customer technical interchanges. Progress reports often provide excellent examples of participation in the different verification tasks (requirements, design and testing).
SE services organizations are often tasked to provide on-site engineers to develop validation plans or to conduct or witness these tests. with specific product	Validation (VAL)	Examples of technical reports documenting the results of validation tests. Technical progress reports containing information describing integration status as well as generated action items.

SE Services Background Descriptions and Examples
Process Category: Support

Process Category	Process Areas
Process Management	Organizational Process Focus Organizational Process Definition + IPPD Organizational Training Organizational Process Performance Organizational Innovation and Deployment
Project Management	Project Planning Project Monitoring and Control Supplier Agreement Management Integrated Project Management + IPPD Risk Management Quantitative Project Management
Engineering	Requirements Management Requirements Development Technical Solution Product Integration Verification Validation
Support 	**Configuration Management** **Process and Product Quality Assurance** **Measurement and Analysis** Causal Analysis and Resolution **Decision Analysis and Resolution**

Process Category: Support

SE Services Background	Process Area	Examples of Project Documents
SE services organization typically interface to CM systems in larger projects or may be tasked to function as the CM manager. The engineers often are members of configuration control boards with authority in specialized technical domains.	Configuration Management (CM)	Copies of configuration status reports showing technical points of contact for controlled documents. Copies of configuration control board meetings and action items.
SE services organizations typically do not perform "formal" quality assurance activities for their projects. There may be participation in the QA activities performed on larger projects Participation by engineers in informal peer reviews is a more frequent implementation of objective evaluation.	Process and Product Quality Assurance (PPQA)	Reports containing documentation of non-compliance or technical reports documenting problems detected during "peer reviews".

Process Category: Support (continued)

SE Services Background	Process Area	Examples of Project Documents
SE services project managers typically report cost and schedule performance measurements as part of progress reports and status reviews. Technical performance measurements are reported while defining and refining operational concepts and performing analysis to balance technical performance, cost and schedule or performance testing.	Measurement and Analysis (MA)	Technical progress reports containing project status information or analysis of planned functional performance or actual performance measurements collected during testing.
Selection of alternative hardware or architectures is documented in technical reports, usually as "trade studies".	Decision Analysis and Resolution (DAR)	Technical reports documenting selection criteria and evaluation of alternatives.

Summary: Comparison of CMMI Implementation Success Factors and Organization Size

CMMI Implementation Success Factors	small settings		large organizations
flatter organization	☑		
efficient communication skills	☑		
flexible processes	☑		
depth of understanding of the business goals	☑		
staff involvement	☑		
staff receptiveness to new ideas	☑		
awareness of existing processes	☑		
simpler process performance models	☑		
process variance simpler to control	☑		
less diversity in products and services	☑		

Small & medium organizations are not "miniatures" of large corporations!

Smaller organizations provide a conducive environment to implement CMMI practices due to:

1. simplicity of organizational structure
2. efficient communications
3. staff receptiveness of new ideas
4. depth of awareness of the processes
5. easier to minimize variance in performing key processes

The End

You have just seen

background descriptions and examples of project documents for SE services organizations from the "30,000 feet" level.

Questions or Comments ?