Recursion in the CMMI Project Management Process Areas

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Agenda

• Goal of the Presentation
• Recursion and Iteration: Defined
• Practicality in Project Management Processes
• Variations in Organizations
• The CMMI Perspective
• Process Consultant Considerations
• Appraisal Considerations
• Summary
Goal of Presentation

- To raise awareness in the community regarding recursive and/or iterative application of CMMI Project Management practices
  - For appraisers
  - For process consultants
  - For EPGs
- To try to help the people that are doing the work
Recursion Defined

“Recursion occurs when a process is applied to successive levels of system elements within a system structure. The outcomes of one application are used as inputs to the next level in the system structure. For example, the verification process is designed to apply to the entire assembled product, the major product components, and even components of components. How far into the product you apply the verification process depends entirely on the size and complexity of the end product.” ¹

¹ Chrissis, Konrad, Schrum . CMMI® 2nd Edition, 2006, p. 84
Recursion – An Example

- A project develops a system, with multiple subsystems and components
- How would the practices of Technical Solutions apply?

Aircraft System
SG 1 Select Product Component Solutions
  SP 1.1 Develop Alternative Solutions and Selection Criteria
  SP 1.2 Select Product Component Solutions
SG 2 Develop the Design
  SP 2.1 Design the Product or Product Component
  SP 2.2 Establish a Technical Data Package
  SP 2.3 Design Interfaces Using Criteria
  SP 2.4 Perform Make, Buy, or Reuse Analyses
SG 3 Implement the Product Design
  SP 3.1 Implement the Design
  SP 3.2 Develop Product Support Documentation

Fire Control Subsystem
SG 1 Select Product Component Solutions
  SP 1.1 Develop Alternative Solutions and Selection Criteria
  SP 1.2 Select Product Component Solutions
SG 2 Develop the Design
  SP 2.1 Design the Product or Product Component
  SP 2.2 Establish a Technical Data Package
  SP 2.3 Design Interfaces Using Criteria
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SG 3 Implement the Product Design
  SP 3.1 Implement the Design
  SP 3.2 Develop Product Support Documentation

Track Software
SG 1 Select Product Component Solutions
  SP 1.1 Develop Alternative Solutions and Selection Criteria
  SP 1.2 Select Product Component Solutions
SG 2 Develop the Design
  SP 2.1 Design the Product or Product Component
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Iteration Defined

“Iteration occurs when processes are repeated at the same system level. New information is created by the implementation of one process that feeds back into a related process. This new information typically raises questions that must be resolved before completing the processes. For example, iteration will most likely occur between requirements development and technical solution. Reapplication of the processes can resolve the questions that are raised. Iteration can ensure quality prior to applying the next process.”

Iteration – An Example

- The Track software is built, but undergoes bug fixes and enhancements

**Track Software**

**SG 1 Select Product Component Solutions**
- SP 1.1 Develop Alternative Solutions and Selection Criteria
- SP 1.2 Select Product Component Solutions

**SG 2 Develop the Design**
- SP 2.1 Design the Product or Product Component
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**SG 3 Implement the Product Design**
- SP 3.1 Implement the Design
- SP 3.2 Develop Product Support Documentation

**Bug Fix**

**SG 1 Select Product Component Solutions**
- SP 1.1 Develop Alternative Solutions and Selection Criteria
- SP 1.2 Select Product Component Solutions

**SG 2 Develop the Design**
- SP 2.1 Design the Product or Product Component
- SP 2.2 Establish a Technical Data Package
- SP 2.3 Design Interfaces Using Criteria
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**SG 3 Implement the Product Design**
- SP 3.1 Implement the Design
- SP 3.2 Develop Product Support Documentation

**Enhancement**

**SG 1 Select Product Component Solutions**
- SP 1.1 Develop Alternative Solutions and Selection Criteria
- SP 1.2 Select Product Component Solutions

**SG 2 Develop the Design**
- SP 2.1 Design the Product or Product Component
- SP 2.2 Establish a Technical Data Package
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- SP 2.4 Perform Make, Buy, or Reuse Analyses

**SG 3 Implement the Product Design**
- SP 3.1 Implement the Design
- SP 3.2 Develop Product Support Documentation
Applies Just to Engineering?

“Engineering processes (e.g., requirements development or verification) are implemented repeatedly on a product to ensure that these engineering processes have been adequately addressed before delivery to the customer. Further, engineering processes are applied to components of the product. For example, some questions that are raised by processes associated with the Verification and Validation process areas may be resolved by processes associated with the Requirements Development or Product Integration process area.

“Recursion and iteration of these processes enable the project to ensure quality in all components of the product before it is delivered to the Customer.”

What about Project Management?

- Do PM processes apply recursively? Iteratively?
  - Does it depend on project size?
  - Do you have IPTs or Functional groups that support your projects? Do you consider the IPT leads or Functional Managers as “Project Managers,” or Cost Account Managers? Do these folks follow the same PM processes as the “Project”?
  - Do you require your project management practices to be applied at this level?
What does Common Sense Say?

- We need to plan what the people that do the work are doing
- We need to report status at the “Project” level and at each level down in the project until we get to the people that are doing the work
- We need to know that the people doing the work are doing the right things
Scenario – Building a Home

• Planning and Status Reporting
  – We expect Rick to have a process for managing the home project
  – Rick expects Fred to have a process for managing the Mechanical tasks
  – Fred expects Tracy, Steve, and Glen to have a process for managing and performing their work

• Rick’s PM role for the home is significantly more complicated than Steve’s or Tracy’s
  – Dependency issues
  – Steve or Tracy may have to support multiple “Rick”s
  – In the end, they are all accountable
Organizational Constructs

• **Functional Organizations**
  – Departments or Divisions by type of work, e.g. Requirements, Development, Engineering, Test
  – Characterized by strong Functional managers, who control the resource allocation
  – Work flows from Functional group to Functional group until completed
  – Project managers establish priorities for the Functional managers, but are not in direct control of the work

• **Project Organizations**
  – Cross-functional teams are established (sometimes called IPTs) to develop and build the product
  – Characterized by strong Project managers (sometimes called IPT Leads) who control resource allocation
  – Work is performed in the context of the team. Teams are made of resources that come from “weak” functional organizations
  – Functional managers are responsible for their function’s process
Project IPT Organization

Recursion in CMMI Project Management PAs
Fred Schenker and Rick Hefner
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CMMI Requirements

• What are typical artifacts that one would expect for a CMMI PM process?

<table>
<thead>
<tr>
<th>WBS</th>
<th>“Lifecycle”</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis of Estimates</td>
<td>Data Management Plan</td>
<td>Commitments</td>
</tr>
<tr>
<td>Budget</td>
<td>List of Stakeholders</td>
<td>Meeting Minutes</td>
</tr>
<tr>
<td>Milestone Review Results</td>
<td>Inventory of Knowledge/Skills</td>
<td>Resource Management Plan</td>
</tr>
<tr>
<td>Action Items</td>
<td>Schedule</td>
<td>EVMS</td>
</tr>
</tbody>
</table>

• Which of these artifacts would be appropriate for a project of any size?
• Do we need all of these artifacts at every level of the project? **NO!**
What is Appropriate?

- Unfortunately, it depends on your organization’s context
- The point is that you should not feel constrained by the CMMI as you apply Project Management processes within your structure
CMMI – Basic PM Process Areas

PMC = Project Monitoring and Control
PP = Project Planning
SAM = Supplier Agreement Management
Process Consultant Considerations

• Recognize the level where the work gets done, and develop a “project” process that is in line with the existing “work products”

• At this (lowest) level of the organization, use the CMMI as a guide, but don’t over-apply the CMMI requirements… allow the overarching project to assume the balance of the CMMI requirements

• …in effect, allocate the CMMI requirement to the level of the organization where it is appropriate

• Don’t worry about consistency between groups… focus on making the groups internally consistent
Appraiser Considerations

• Expect some form of project management at the “worker” level

• Make an effort to understand the organization type during the appraisal planning
  – This will guide your knowledge of how work is managed
  – This may affect the way that the organization is defined
  – Don’t be afraid to limit the scope of the appraisal

• Be prepared for the organization to push back
  – “We have a WBS”
  – “That’s too much process!” “We can’t afford that!”
  – If it’s in scope, you should expect to see it
Summary

• CMMI only defines “what” to do, not “how” to do it
  – CMMI is a process model, not a process description
  – Use the CMMI as a guide to ensure you are doing all
    the right things
  – Plan the process implementation so that you are taking
    advantage of the CMMI

• Project Management process deployment is
  more complicated than you think
  – For the process consultant to help the organization
    define the process
  – For the process appraiser in determining the
    organization is following the process