
Interpreting the DoD-Biased CMMI for Commercial Industries

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Agenda

- Overview
- Hypothetical Case Study
- Terminology Translations
- Implementation Decisions
- Key PA-related Issues

Opening Thought

- Many companies achieve CMM/CMMI level X but fail to show any real performance improvement
 - Applies to both defense firms & commercial firms – may be more prevalent in commercial firms
- Maybe the reason is because the scope of their process improvement efforts is too narrow; i.e. they are not improving those areas most in need of improvement
 - Maybe the CMMI can help
 - But to help it must be interpreted (and/or applied) correctly
 - And that's what this SPIN talk is really about

D'Ambrosa's First Law

"Flexibility and capability are inversely proportional to ease of use."

- This "law" is based on empirical evidence associated with development tools, household appliances, etc.
- The law can be applied to the CMMI
 - Flexible enough to be applied to many disciplines other than software and to a variety of industries
 - But this flexibility make interpretations more difficult and misuse more likely
 - This is exacerbated by the bias of the model language toward its funding agent, the US Dep't of Defense (DoD)

D'Ambrosia's Second Law

"If everyone agrees with everything you've said, you've wasted energy talking."

- So, my apologies in advance if I challenge accepted process improvement initiative methods
- My goal is to get you to think about the issues, not to agree with my approach

Proper Interpretation Is Needed

- The SEI's CMMI clearly has a huge advantage over its predecessor, the SW-CMM, due to its broad applicability and generic language
- But nevertheless it is still funded by the US DoD and retains some of that bias in its language and emphases
 - This bias presents some commercial IT-based initiatives with an interpretive challenge
- In particular the choice of a representation, interpretations of terminology, ramifications of extensive outsourcing, and PA-specific issues need IT-based discussion
- All of these support the author's premise that the CMMI can provide much more business benefit than the SW-CMM, but only if it is interpreted in a manner that fits the business

The Method

- We'll use an imaginary insurance company with a typical (if there is such a thing) IT structure and interpret the CMMI for that company by answering some key questions
 - Sort of combining Greek mythology with the Socratic method
- Even if your company is very much like my imaginary one, you may not agree with my answers
- That's fine – the point here is much more the questions and thought process, rather than the answers
- One more point – most of my thoughts here are based on reflections of what could have been done better in my experiences working with IT or development groups

Idealism vs. Pragmatism

- Most of us live in two conflicting worlds
 - The ideal: process improvement for its own sake; focusing on performance, quality, etc.
 - The pragmatic: the ideal tempered by schedule and cost constraints, and often driven by appraisal goals
- The trick is to have our feet in both and still maintain our balance
- For tonight the focus is on the ideal
 - Approaches may need to vary to deal with the pragmatic
 - But even if pragmatism drives short-term decisions, hopefully idealism will drive long-term decisions

But First – Some Words from Our Sponsor

- Capability Maturity Models (CMM) were initiated by the US DoD in the late 1980's in reaction to the poor performance in software-related contracts
- They provide a rigorous set of requirements (in the form of goals and practices) and a mechanism for objective assessment of implementation
- Adopted world-wide
- CMMI = Capability Maturity Model Integration
- CMMI built from SW-CMM plus systems, IPPD, and Source Selection models or components
- Will replace SW-CMM, which is being sunset by SEI

Staged Representation

- Provides a proven sequence of improvements, beginning with basic management practices and progressing through a predefined and proven path of successive levels, each serving as a foundation for the next
- Permits comparisons across and among organizations by the use of maturity levels
- Provides an easier migration from the SW-CMM to CMMI; similar "maturity levels"
- Provides a single rating that summarizes appraisal results and allows comparisons among organizations

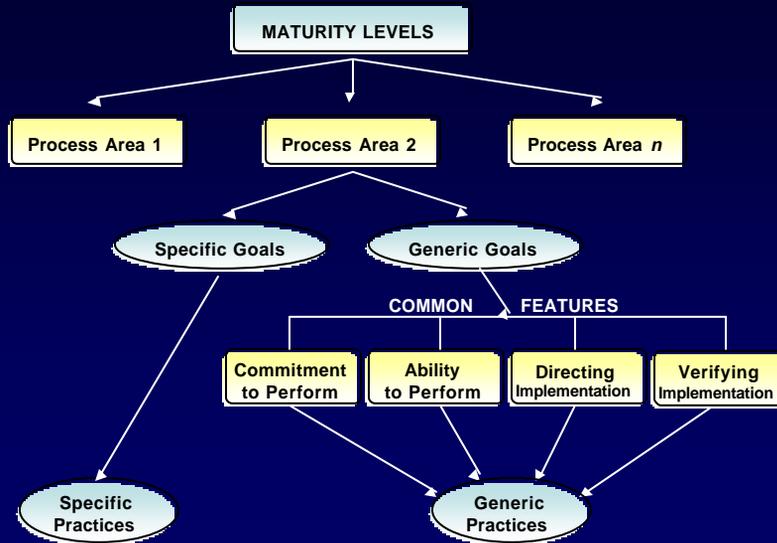
Continuous Representation

- Allows you to select the order of improvement that best meets the organization's business objectives and mitigates the organization's areas of risk
- Enables comparisons across and among organizations on a Process Area by Process Area basis or by comparing results through the use of equivalent staging
- There are no "maturity levels"; rather the Process Areas (PAs - equivalent of SW-CMM KPAs) may be independently rated to determine their "capability level"

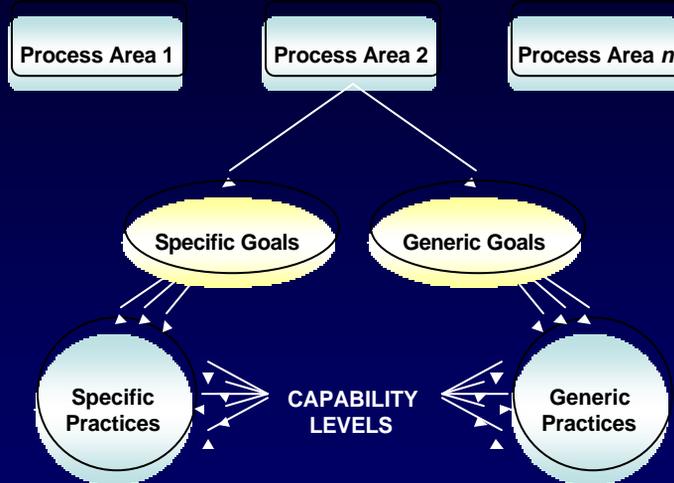
Staged v. Continuous

- Whether used for process improvement or appraisals, both representations are designed to offer essentially equivalent results
- There are very few model differences; i.e. both models can be built from (essentially) the same basic components
- Companies that choose the staged generally use a continuous approach between levels
- Companies that choose continuous generally sequence the PAs according to the staged levels
- Thus in principle the choice of a model may lead to very different approaches, but in practice the differences are slight

STAGED - Components



CONTINUOUS - Components



CONTINUOUS - Process Area Groupings

- The full CMMI Model has 25 Process Areas (PAs), regardless of representation
- For the Continuous Model (and the Staged Model) the PAs are arranged into 4 groups:
 - Process Management
 - Project Management
 - Engineering
 - Support

The CMMI Process Areas

(CMMI - SE/SW/PPD/SS V1.1)

KEY
Basic Process Areas (PAs)
Advanced PAs
Engineering PAs

Process Management Processes	Project Management Processes	Engineering Processes	Support Processes
Organizational Process Focus	Project Planning	Requirements Development	Configuration Management
Organizational Process Definition	Project Monitoring and Control	Requirements Management	Process & Product Quality Assurance
Organizational Training	Supplier Agreement Management	Technical Solution	Measurement and Analysis
Organizational Process Performance	Integrated Project Management	Product Integration	Decision Analysis and Resolution
Organizational Innovation & Deployment	Risk Management	Verification	Organizational Environment for Integration
	Integrated Teaming	Validation	Causal Analysis and Resolution
	Integrated Supplier Management		
	Quantitative Project Management		

Top Ten Reasons for Choosing the CMMI ₁

- Reason #10: It is likely that achieving a minimum CMMI maturity level will be an organizational goal in the future
- Reason #9: The CMMI contains almost ten years of pending improvements to the extremely successful SW-CMM. In addition the infusion of best commercial practices (about half of the model development team was outside the defense world) is a plus for the model
- Reason #8: Process infrastructure needs to keep pace with project & organizational infrastructure. To that end the CMMI is well supported by training, assessment mechanisms, and conferences

Top Ten Reasons for Choosing the CMMI ₂

- Reason #7: CMMI was developed and will be maintained as an all-encompassing model. Its staged and continuous representations and optional inclusion of IPPD and Source Selection model elements provide many options
- Reason #6: Development complexity begs for maximally structured processes. The CMMI provides that structure without costly independent development; it simultaneously has more depth and breadth than competing process models.
- Reason #5: The use of CMMI provides the opportunity to join separate and possibly redundant (and therefore not cost-effective) process improvement initiatives under a common umbrella

Top Ten Reasons for Choosing the CMMI ₃

- Reason #4: The focus of cross-discipline teams, supported by the use of an integrated model such as the CMMI, can deal more effectively with the ebb and flow of the life cycle than the strict stages of classical development
- Reason #3: The use of a common model arguably provides the best opportunity for the spread of best practices and supports the organizational changes that are continually being made to keep pace with ever-changing market demands
- Reason #2: The CMMI is in tune with modern technologies and concurrent engineering, and emphasizes such things as requirements elicitation, cross-functional teams, partnering, hardware and software acquisitions, etc.

Top Ten Reasons for Choosing the CMMI ₄

- And ... Reason #1: The US government may be slow, but it is not stupid. If the DoD has been funding the SEI for nearly 20 years, you can be sure it is convinced that there is a significant ROI. Furthermore, based on all of the above, it is reasonable to expect that the CMMI ROI should meet or exceed the SW-CMM ROI if one employs the model from a business perspective and properly interprets it for your business.

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The Company₁

- Our hypothetical company is the Lifeline Insurance Corporation (LIC)
- LIC has an IT organization which provides computer infrastructure and develops the applications (software) to support the business
- In addition to the project teams the IT organization has support elements, including
 - The Project Management Office (PMO), which provides some of the management functions (especially oversight & reporting)
 - A Quality Assurance (QA) group, which is responsible for some of the testing, and some of the other QA activities
 - A Chief Technical Officer (CTO) and staff, which has responsibility for technical tasks such as choice of tools, architecture, etc.
 - A Vendor Management (VM) group which does vendor selection, contracting, & monitoring – “vendors” include staff augmentation & onshore/offshore outsourcing

The Company₂

- IT is led by its Chief Information Officer (CIO)
- The CIO and his/her staff perform annualized planning
 - Development activities and staffing levels are determined prior to the beginning of the year
 - Budgets are set accordingly; adjustments to budgets and/or applications functionality are made during the year
- Software development is done by the project teams, the CTO, and, of course, the vendors
- There are dedicated Business Analysts on the project teams and each project also has a dedicated liaison with the business
- There is an SEPG reporting to the CTO which is responsible for process-related activities

The Company₃ - Outsourcing

- Over 80% of the actual software development is outsourced
- The vendors use their own development procedures but interface to LIC through the use of a common CM repository
- Some, but not all, of the vendors develop software requirements (lower-level requirements) and/or perform system test
- Most of the vendors have a high CMM/CMMI maturity level

Why Does the Company Structure Matter?

- The CMMI SPs & GPs can be regarded as requirements
 - E.g. PP SP 1.3 – define project life cycle
- Thus the CMMI tells us “what” to do – the “why, who, how, and when” are left to us
- The “why” goes back to the pragmatist vs. idealist discussion
- Company procedures normally focus on “how” and “when”, but due to the fragmented responsibilities of LIC, clearly the choice of “who” will constrain the choices for “how” and “when”
 - This is less of an issue for defense contractors because projects are more autonomous

Lesson Learned: Work on organizational charters before organizational procedures

LIC Business Need

- LIC has observed that the average retirement age has increased
- Based on market research they have decided to issue a new insurance policy – “Life Paid Up at 70” (LPU@70)
- This will result in new applications, extensively modified applications, and slightly modified applications
- Applications affected include: marketing software, billing software, pay-out software, etc.
- The CTO also maintains various data bases shared by multiple applications which need to be updated

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Terminology₁

- In line with my mathematics background, now that we have our assumptions (organizational structure of LIC), we now have our definitions
- More precisely, we will take some key terms from the CMMI glossary, state the definition from the model, and then “instantiate” that definition for LIC

Terminology₂

- Allocated requirement
 - CMMI: Requirement that levies all or part of the performance and functionality of a higher level requirement on a lower level architectural element or design component.
 - LIC amplification: High level (business) requirements are allocated to applications and/or data bases.
- Discipline
 - CMMI: The word “discipline,” when used in the CMMI Product Suite, refers to the bodies of knowledge available to you when selecting a CMMI model (e.g., systems engineering). The CMMI Product Team envisions that other bodies of knowledge will be integrated into the CMMI Framework.
 - LIC amplification: Software and Systems Engineering are the appropriate bodies of knowledge, but LIC personnel performing these functions will have varying titles. (More later.)

Terminology₃

- Integrated product and process development
 - CMMI: A systematic approach to product development that achieves a timely collaboration of relevant stakeholders throughout the product life cycle to better satisfy customer needs.
 - LIC amplification: Relevant stakeholders may include business people as well as IT personnel.
- Interface control
 - CMMI: In configuration management, the process of (1) identifying all functional and physical characteristics relevant to the interfacing of two or more configuration items provided by one or more organizations, and (2) ensuring that the proposed changes to these characteristics are evaluated and approved prior to implementation.
 - LIC amplification: Provides a controlled way of piecing together the applications to support LPU@70

Terminology₄

- Operational scenario
 - CMMI: A description of an imagined sequence of events that includes the interaction of the product with its environment and users, as well as interaction among its product components. Operational scenarios are used to evaluate the requirements and design of the system and to verify and validate the system.
 - LIC amplification: These are basically use cases.
- Organization
 - CMMI: An organization is typically an administrative structure in which people collectively manage one or more projects as a whole, and whose projects share a senior manager and operate under the same policies. However, the word “organization” as used throughout CMMI models can apply to one person who performs a function in a small organization that might be performed by a group of people in a large organization. LIC amplification: Should include the business people defining requirements and providing funding.
 - LIC amplification: The business people + the IT organization.

Terminology₅

- Organizational unit
 - CMMI: That part of an organization that is the subject of an appraisal (also known as the organizational scope of the appraisal).
 - An organizational unit deploys one or more processes that have a coherent process context and operates within a coherent set of business objectives. An organizational unit is typically part of a larger organization, although in a small organization, the organizational unit may be the whole organization.
 - LIC amplification: This is most likely just the IT organization.
- Outsourcing
 - CMMI: The process of obtaining, through contract, any discrete action or proposed action by the acquisition entity that would commit to invest (appropriated funds) for obtaining products and services.
 - LIC amplification: CMMI synonym for this term is acquisition.

Terminology₆

- Process owner
 - CMMI: The person (or team) responsible for defining and maintaining a process. At the organizational level, the process owner is the person (or team) responsible for the description of a standard process; at the project level, the process owner is the person (or team) responsible for the description of the defined process. A process may therefore have multiple owners at different levels of responsibility.
 - LIC amplification: All the groups in It (PMO, CTO, etc.) are potential process owners; the SEPG owns some organizational processes (OPF, OPD PAs), but not much else

Terminology₇

- Project
 - CMMI: In CMMI models, a “project” is a managed set of interrelated resources that delivers one or more products to a customer or end user. This set of resources has a definite beginning and end and typically operates according to a plan. Such a plan is frequently documented and specifies the product to be delivered or implemented, the resources and funds used, the work to be done, and a schedule for doing the work. A project can be composed of projects.
 - LIC amplification: The projects typically relate to the work required to update or create an application for business initiatives such as LPU@70. But, as seen from the last statement in the definition, the update or creation of all the applications for LPU@70 could also be called a “project” – LIC calls this a “program” (i.e. a program is a related collection of projects).

Terminology₈

- Project manager
 - CMMI: In the CMMI Product Suite, a “project manager” is the person responsible for planning, directing, controlling, structuring, and motivating the project. The project manager is responsible for satisfying the customer.
 - LIC amplification: Generally a junior person with limited responsibility (much less than defense firm’s PMs); but LIC also has program managers to manage the collection of projects needed to deliver LPU@70. The CMMI “project manager” at LIC is actually a collection of people, not a single person.

Terminology₉

- Requirement
 - CMMI: (1) A condition or capability needed by a user to solve a problem or achieve an objective. (2) A condition or capability that must be met or possessed by a product or product component to satisfy a contract, standard, specification, or other formally imposed documents. (3) A documented representation of a condition or capability as in (1) or (2).
 - LIC amplification: As the CMMI definition indicates, this has different levels of meaning
 - Level (1) would be the general requirements for LPU@70 – this includes technical requirements in addition to business requirements (need dates, budgetary constraints, etc.)
 - Level (2) would be the requirements allocated to each application and/or project
 - Level (3) would be the translation of the latter into software requirements – this is done by the vendors in some cases

Terminology₁₀

- Software engineering
 - CMMI: (1) The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software. (2) The study of approaches as in (1).
 - LIC amplification: LIC has very few real software engineers; they are largely vendors
- Systems engineering
 - CMMI: The interdisciplinary approach governing the total technical and managerial effort required to transform a set of customer needs, expectations, and constraints into a product solution and support that solution throughout the product's life.
 - LIC amplification: Although no one at LIC has this title, many of the IT professionals and some of the business people fill this role

Terminology₁₁

- Trade study
 - CMMI: An evaluation of alternatives based on criteria and systematic analysis, to select the best alternative for attaining determined objectives.
 - LIC amplification: For defense firms, this is done as design tradeoffs; the business people sometimes do similar things, but in a less structured fashion.
- Work breakdown structure (WBS)
 - CMMI: An arrangement of work elements and their relationship to each other and to the end product.
 - LIC amplification: These are generally the major line items on the master schedule for each project; relationships are captured in planning documents and reflected as schedule dependencies.

Takeaway

- There are over one hundred terms in the CMMI glossary
- This section covered about 20 of them
- Every CMMI term must be interpreted for the company to get effective implementation

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Model Scope

- Which CMMI model?
 - Software – of course
 - System Engineering – definitely, with the interpretation of system engineering mentioned earlier (taking the idealistic path, of course)
 - IPPD – hard to exclude since the definition fits – but difficult because it is inconsistent with organizational structure & has a definite DoD flavor (since defense firms typically use IPT-based developments (IPT = Integrated Product Team))
 - Source Selection – not worth the additional effort
- Which representation (staged or continuous)? Implementing some PAs (especially at Level 3) may have little ROI; so staged is fine for Level 2, but if LIC wants to go higher, continuous may be a better choice

Organizational/Functional Scope

- Should include all of IT and key business people (stakeholders) in CMMI initiative
- Vendors not included (except where vendors use LIC's procedures, tools, platforms, etc.), but, of course, management of vendors is
- For appraisals, scope can be limited to IT (per CMMI glossary term – organizational unit)
- Must remember that “program managers” and “system engineers” include many personnel with a different LIC title
- May need to include such groups as HR (or whoever provides internal IT training (not user training), depending on PA scope)

The CMMI and Other Initiatives

- The CMMI, unlike CMM, is not an isolated initiative
- Nearly all of LIC needs to be engaged
- Other PI initiatives are within the CMMI umbrella (CMMI is the most broad) – e.g. PMI, Six Sigma
- The important thing is to properly consolidate other initiatives so there is no redundancy and competition for senior management support and resources

Process Infrastructure

- Like CMM, an SEPG (or some such working group) can provide the coordination function and maintain the “Organizational Set of Standard Processes” and related “Process Assets”
 - SEPG needs to be staffed with reps from IT groups, not just “process professionals”
 - IT groups need to be process owners for buy-in
- Need senior management oversight
 - Best done through a steering group composed of senior IT and relevant business people
 - Funding not sufficient; need visible support

Process Development

- View process development itself from system engineering principles
- For example allocate CMMI SPs & GPs to the owner(s) and to the process components
 - Include “direct artifact allocation” for efficient appraisals
- Tailoring approach is a key
 - Suggest using a “menu” approach in which procedures contain choices (tailoring) with rationale (tailoring guidelines) which assures CMMI compliance irrespective of tailoring decisions
- Is difficult to get “power users” to be effective process owners
 - Also inefficient, but keep at it
- Use pilots where really needed and establish firm grandfathering rules
- Keep training material (especially the “why’s”) out of the processes
 - Rather establish hyperlinks from processes to training material

Metrics

- Although there is no “Me 1” in the CMMI the examples in the CMMI model suggest GP 2.8 has the same effect
 - This suggests (but does not require) a metric (or several metrics, per discipline or goals/practices) for each PA within scope of the CMMI effort
- In addition, the CMMI (like the Sw-CMM) requires a three-phase estimation approach: attribute (or “size”), effort, & cost
 - Effort estimates must be based on historical data relating effort to these attributes; e.g. a Test Plan may have n pages (an attribute) and history indicates an effort of m hours per page (historical data)
 - For software a single attribute usually suffices (e.g. lines of code or function points)
 - For system engineering the choice is not so clear and little help is found in the literature

Generic Practice (GP) Issues

- Although many GPs are to a large extent “globally” satisfied, such as training and CM, even those generally require separate organizational and project procedures and/or artifacts
- The other GPs, such as planning, typically requiring separate procedures and/or artifact for each PA
- While such things as “planning for CM” are obvious, others, such as “planning for Measurement and Analysis” are not and tend to lead to the creation of procedures which are of negligible value if one isn’t very creative

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Key Issues with Key PAs

Sequenced according to Continuous Representation:

- The Process Management Process Areas (PAs)
- The Project Management Process Areas (PAs)
- The Engineering Process Areas (PAs)
- The Support Process Areas (PAs)

Process Management Process Areas

- Organizational Process Focus (OPF)
- Organizational Process Definition (OPD)
- Organizational Training (OT)

(Note: the remaining two L4/5 PAs will not be covered)

Organizational Process Focus (OPF) ₁

- The purpose of OPF is to plan and implement organizational process improvement based on a thorough understanding of the current strengths and weaknesses of the organization's processes and process assets
- Specific Goals:
 - Determine Process-Improvement Opportunities: Strengths, weaknesses, and improvement opportunities for the organization's processes are identified periodically and as needed
 - Plan and Implement Process-Improvement Activities: Improvements are planned and implemented, organizational process assets are deployed, and process-related experiences are incorporated into the organizational process assets

Organizational Process Focus (OPF) ₂

- Process improvement initiatives should be sponsored at various corporate levels
- Strong process infrastructure – with right people – a must
- Flowdown of process-related objectives
- Process appraisals (CBA IPI, SCAMPI)
- Corporate award programs are process-focused?
- Process initiatives handled like a project (e.g. planned & tracked)

Organizational Process Definition (OPD) ₁

- The purpose of Organizational Process Definition is to establish and maintain a usable set of organizational process asset
- Specific Goals:
 - Establish Organizational Process Assets: A set of organizational process assets is established and maintained

Organizational Process Definition (OPD) ₂

- The organization's process asset library is a collection of items maintained by the organization for use by the people and projects of the organization
 - This collection of items includes descriptions of processes and process elements, descriptions of life-cycle models, process tailoring guidelines, process-related documentation, and data
 - The organization's process asset library supports organizational learning and process improvement by allowing the sharing of best practices and lessons learned across the organization
- The organizational process assets may be organized in many ways, depending on the implementation of the Organizational Process Definition process area
 - Suggestion: have multiple views

Organizational Training (OT) ₁

- The purpose of Organizational Training is to develop the skills and knowledge of people so they can perform their roles effectively and efficiently
- Specific Goals:
 - Establish an Organizational Training Capability: A training capability that supports the organization's management and technical roles is established and maintained
 - Provide Necessary Training: Training necessary for individuals to perform their roles effectively is provided

Organizational Training (OT) ₂

- Training needs must be:
 - Coordinated and prioritized between disciplines
 - Based on organizational, project, and individual (career growth) needs
- Training must be organizationally planned, not ad hoc
- Centralized training records should be maintained
- Accountability for delivery of planned training must be established
- Training effectiveness must be measured (especially the effect on work environment, not just the training itself)
- Again: this is training of IT personnel, not the users
 - Many IT organizations have no internal training capability

Project Management Process Areas

- Project Planning (PP)
- Project Monitoring and Control (PMC)
- Supplier Agreement Management (SAM)
- Integrated Project Management for IPPD* (IPM)
- Risk Management (RSKM)
- Integrated Teaming (IT)

* Integrated Process and Product Development, one of the four capability maturity models which have been integrated to form CMMI. The others are software, systems, and supplier sourcing.

Note: Integrated Supplier Management (L3) and Quantitative Project Management (L4) are not covered in this presentation.

Project Planning (PP) ₁

- The purpose of Project Planning is to establish and maintain plans that define project activities
- Specific Goals:
 - Establish Estimates: Estimates of project planning parameters are established and maintained
 - Develop a Project Plan: A project plan is established and maintained as the basis for managing the project
 - Obtain Commitment to the Plan: Commitments to the project plan are established and maintained

Project Planning (PP) 2

- WBS flows down from program office to development (where detail added)
- Choice of life cycle accounts for requirement growth, prototypes, incremental deliveries, etc.
- Estimation must begin with procedurally determining size or attributes (how big/difficult – not how long)
 - Then effort estimates procedurally take into account historical data and environmental variables (e.g. staff or technology issues)
 - Third (easiest) is to convert to cost – OK to push off to finance, but be aware of results

Project Planning (PP) 3

- Requirements + life cycle + estimates are basis of detailed planning
- Planning documents should be layered – program plans (i.e plan for LPU@70), project plans, test plans – all reflect dependencies & interdisciplinary review
- Schedules need to be tied to estimates and developed from procedures – tied to milestones; includes assumptions, constraints, & dependencies
- Plans generally need to include risks, data management, resources, skills & training needs, stakeholder involvement, & splintered project management function – in addition to schedule
- Getting commitment from all stakeholders to all planning aspects is a key theme – these stakeholders generally serve many masters

Project Monitoring and Control (PMC)₁

- The purpose of Project Monitoring and Control is to provide an understanding of the project's progress so that appropriate corrective actions can be taken when the project's performance deviates significantly from the plan
- Specific Goals:
 - Monitor Project Against Plan: Actual performance and progress of the project are monitored against the project plan
 - Manage Corrective Action to Closure: Corrective actions are managed to closure when the project's performance or results deviate significantly from the plan

Project Monitoring and Control (PMC)₂

- All planning parameters are monitored – in particular estimates (size, effort, & cost) are monitored
- While planning is top-down, monitoring is bottoms-up
- All planning elements are monitored – e.g. risks, data management, resources, skills & training needs, stakeholder commitment, & IPTs – not just the schedule
- This is monitoring the project and support people & again is at two levels – program & project(s)
- Few IT groups use EVMS (a defense industry standard) and most are lax in time tracking – so beware

Project Monitoring and Control (PMC)₃

- Reviews at all levels (team meetings to phase reviews) are performed according to a procedure with increasing formality
- The purpose of all monitoring is corrective action
 - Early Warning Indicators are important
 - Examples imperative
 - CMMI is looking for something other than increased overtime

Supplier Agreement Management (SAM)₁

- The purpose of Supplier Agreement Management is to manage the acquisition of products from suppliers for which there exists a formal agreement
- Specific Goals:
 - Establish Supplier Agreements: Agreements with the suppliers are established and maintained
 - Satisfy Supplier Agreements: Agreements with the suppliers are satisfied by both the project and the supplier

Supplier Agreement Management (SAM) ₂

- The SAM process area involves the following:
 - Determining the type of acquisition that will be used for the products to be acquired
 - Selecting suppliers
 - Establishing and maintaining agreements with suppliers
 - Executing the supplier agreement
 - Accepting delivery of acquired products
 - Transitioning acquired products to the project
- Source selection must be based on procedural criteria
 - Unlike SW-CMM COTS acquisition also included & emphasized

Supplier Agreement Management (SAM) ₃

- With the extent that outsourcing is used, this is arguably the most critical PAu
- Like PM, SAM is shared between many groups, it is not just the responsibility of Vendor Management
- Having all the “teeth” in the contract a key
 - SOW, Ts & Cs, deliverables (review/approve), procedural flow down, formal reviews, change management, contract revision
- Must talk to a win/win mentality

Integrated Project Management for IPPD (IPM)₁

- The purpose of IPM is to 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
- For Integrated Product and Process Development (IPPD), IPM also covers the establishment of a shared vision for the project and a team structure for integrated teams that will carry out the objectives of the project

Integrated Project Management for IPPD (IPM)₂

- Specific Goals:
 - Use the Project's Defined Process: The project is conducted using a defined process that is tailored from the organization's set of standard processes
 - Coordinate and Collaborate with Relevant Stakeholders: Coordination and collaboration of the project with relevant stakeholders is conducted
 - Use the Project's Shared Vision for IPPD: The project is conducted using the project's shared vision
 - Organize Integrated Teams for IPPD: The integrated teams needed to execute the project are identified, defined, structured, and tasked

Integrated Project Management for IPPD (IPM)₃

- This PA is the instantiation of the OPF & OPD PAs through the use of organizational assets, which is one of the key Level 3 concepts:
 - Project procedures are developed by tailoring the organizational procedures according to the tailoring guidelines
 - Project planning relies strongly on organizational assets (e.g. historical data, lessons learned) & includes level 3 activities such as Peer Reviews and Training Plans
 - Projects contribute data to organizational metrics repositories
- The other key aspect of this PA is the structured management of stakeholder involvement and dependencies
- The last two IPPD goals are skipped if the basic Software/Systems Engineering model is being used

Risk Management (RSKM)₁

- The purpose of Risk Management is to identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives
- Specific Goals:
 - Prepare for Risk Management: Preparation for risk management is conducted
 - Identify and Analyze Risks: Risks are identified and analyzed to determine their relative importance
 - Mitigate Risks: Risks are handled and mitigated, where appropriate, to reduce adverse impacts on achieving objectives

Risk Management (RSKM) ₂

- Like all PAs, risk management must be layered – there are program (or business – LPU@70) level risks and lower software-related risks, all of which must be coordinated
- The management consists of the usual steps; identification, quantification (likelihood of occurrence and impact), and mitigation (containment and/or contingency planning)
- The best evidence is to provide examples of specific (non-generic) program risks and indicate how they were handled in accordance with standard procedures

Integrated Teaming (IT)

- The purpose of Integrated Teaming is to form and sustain an integrated team for the development of work products
- Specific Goals:
 - Establish Team Composition: A team composition that provides the knowledge and skills required to deliver the team's product is established and maintained
 - Govern Team Operation: Operation of the integrated team is governed according to established principles
- This PA is only relevant if IPPD model component is being used, so we won't elaborate

Engineering Process Areas

- Requirements Management
- Requirements Development
- Technical Solution
- Product Integration
- Verification
- Validation

Note: For all of these PAs much of these are done by the vendors & procedures (& choice of PAs for appraisals) should reflect that fact

Requirements Management (REQM) ₁

- The purpose of Requirements Management is to manage the requirements of the project's products and product components and to identify inconsistencies between those requirements and the project's plans and work products
- Specific Goals:
 - Manage Requirements: Requirements are managed and inconsistencies with project plans and work products are identified

Requirements Management (REQM) ₂

- The requirements to be managed include both technical and non-technical requirements as well as those requirements levied on the project by the organization
 - In particular, if the Requirements Development process area is implemented, its processes will generate program (LPU@70) and project requirements that will also be managed by the requirements management processes
- Don't confuse this with analysis (Requirements Development PA)
- Emphases are on identification of requirements sources, dialog with requirements providers, review of and commitment to requirements, managing changes, bidirectional traceability to other work products, and maintaining appropriate consistency among work products
- Keys are dialogue with business people (requirements providers) & change management/traceability

Requirements Development (RD) ₁

- The purpose of Requirements Development is to produce and analyze customer, product, and product-component requirements (for LIC, product = LPU@70 & product-components = supporting applications)
- Specific Goals:
 - Develop Customer Requirements: Stakeholder needs, expectations, constraints, and interfaces are collected and translated into customer requirements
 - Develop Product Requirements: Customer requirements are refined and elaborated to develop product and product-component requirements
 - Analyze and Validate Requirements: The requirements are analyzed and validated, and a definition of required functionality is developed

Requirements Development (RD) ₂

- RD must include interfaces (which are sometimes design, but more often requirements) and performance requirements – this may be a critical issue to manage numerous applications and data bases
- Based on appropriate modern methodologies – use cases, object-oriented techniques, functional partitioning, etc.
- Analysis, simulations, and prototypes can serve as (early) requirements validation (peer reviews are verification)
- Includes documentation standards, baselines, etc.

Technical Solution (TS) ₁

- The purpose of Technical Solution is to design, develop, and implement solutions to requirements
 - Solutions, designs, and implementations encompass products, product components, and product-related lifecycle processes either singly or in combinations as appropriate
- Specific Goals:
 - Select Product-Component Solutions: Product or product-component solutions are selected from alternative solutions
 - Develop the Design: Product or product-component designs are developed
 - Implement the Product Design: Product components, and associated support documentation, are implemented from their designs

Technical Solution (TS) ₂

- Development of alternative solutions and selection criteria should be an essential part of the solution
 - Not a typical IT effort
- Operational concepts and scenarios (or use cases) should evolve in conjunction with solution
- Solutions (approaches) are identified from alternatives
- Designs are developed hierarchically by using organizational methodologies
- Technical data packages are used to capture all levels of design
 - It probably uses different terminology
- Product support documentation is produced (user's manuals)

Product Integration (PI) ₁

- The purpose of Product Integration is to assemble the product from the product components, ensure that the product, as integrated, functions properly, and deliver the product
- Specific Goals:
 - Prepare for Product Integration: Preparation for product integration is conducted
 - Ensure Interface Compatibility: The product-component interfaces, both internal and external, are compatible
 - Assemble Product Components and Deliver the Product: Verified product components are assembled and the integrated, verified, and validated product is delivered

Product Integration (PI) ₂

- Preparation implies plans are made to achieve complete product integration through progressive assembly of product components, in one stage or in incremental stages, according to a defined integration sequence and procedures
 - At the lowest level this is software integration (e.g. iterative addition of components until there is a complete working application)
 - At the highest level this is the integration of applications, data bases, production hardware, etc. to have the full complement of capability to support LPU@70
- Each level of integration is performed according to planned sequence and procedures
- Integrated components and full product are evaluated

Verification (VER) ₁

- The purpose of Verification is to ensure that selected work products meet their specified requirements
- Specific Goals:
 - Prepare for Verification: Preparation for verification is conducted
 - Perform Peer Reviews: Peer reviews are performed on selected work products
 - Verify Selected Work Products: Selected work products are verified against their specified requirements

Verification (VER) ₂

- Preparation includes determining: the work products, or portion of work products to be verified; the verification method and environment; verification procedures; and personnel
 - Methods of verification include, but are not limited to, inspections, peer reviews, audits, walkthroughs, analyses, simulations, testing, and demonstrations
 - Preparation decisions are included in planning documents at an aggregate level
- Peer reviews – in particular inspections – are a focused method of verification
- Verification results are catalogued and analyzed for corrective action

Validation (VAL) ₁

- The purpose of Validation is to demonstrate that a product or product component fulfills its intended use when placed in its intended environment
- Specific Goals:
 - Prepare for Validation: Preparation for validation is conducted
 - Validate Product or Product Components: The product or product components are validated to ensure that they are suitable for use in their intended operating environment
- Most IT groups call this user acceptance testing and/or system testing
- Again, interpret product and product component as above

Validation (VAL) ₂

- Validation includes determining: the products, or product components to be verified; the validation method and environment; validation procedures; and personnel
 - Methods of validation include, but are not limited to, test, analysis, inspection, demonstration, or simulation
 - Preparation decisions are usually included in test planning documents
- Testing is a focused method of validation
- Verification results are catalogued and analyzed for corrective action

Support Process Areas

- Configuration Management
- Process and Product Quality Assurance
- Measurement and Analysis
- Decision Analysis and Resolution
- Organizational Environment for Integration

(Note: the remaining L5 PA will not be covered)

Configuration Management (CM) ₁

- The purpose of Configuration Management is to establish and maintain the integrity of work products using configuration identification, configuration control, configuration status accounting, and configuration audits
- Specific Goals:
 - Establish Baselines: Baselines of identified work products are established
 - Track and Control Changes: Changes to the work products under configuration management are tracked and controlled
 - Establish Integrity: Integrity of baselines is established and maintained
- Configuration management of work products may be performed at several levels of granularity
 - Configuration items can be decomposed into configuration components and configuration units

Configuration Management (CM) ₂

- Baselines provide a stable basis for continuing evolution of configuration items
 - An example of a baseline is an approved description of a product that includes internally consistent versions of requirements, requirement traceability matrices, design, discipline-specific items, and end-user documentation (i.e. integrity of the configuration)
 - Changes to baselines and the release of work products built from the configuration management system are systematically controlled and monitored via the configuration control, change management, and configuration auditing functions of configuration management
- This process area applies not only to configuration management on projects, but also to configuration management on organization work products such as standards, procedures, and reuse libraries

Process and Product Quality Assurance (PPQA) ₁

- The purpose of Process and Product Quality Assurance is to provide staff and management with objective insight into processes and associated work products
- Specific Goals:
 - Objectively Evaluate Processes and Work Products: Adherence of the performed process and associated work products and services to applicable process descriptions, standards, and procedures is objectively evaluated
 - Provide Objective Insight: Noncompliance issues are objectively tracked and communicated, and resolution is ensured

Process and Product Quality Assurance (PPQA) ₂

- Defense forms normally have dedicated organization(s) performing this function (e.g. SQA) – IT groups usually need to staff this from existing structure
- Process assurance contributes to reducing defect injection
- Product assurance contributes to increasing defect detection
- Objectivity is typically, but not necessarily, supported by independent reporting channels
- Because of its tie-in to processes, the role of PPQA matures in parallel with the organization
- Like just about everything else in the CMMI PPQA is a planned activity
- Business value is tied to extent PPQA serves project management

Measurement and Analysis (MA) ₁

- The purpose of Measurement and Analysis is to develop and sustain a measurement capability that is used to support management information needs
- Specific Goals:
 - Align Measurement and Analysis Activities: Measurement objectives and activities are aligned with identified information needs and objectives
 - Provide Measurement Results: Measurement results that address identified information needs and objectives are provided

Measurement and Analysis (MA) ₂

- Measurement objectives should include: project tracking, tracking of quantified organizational objectives, and measurements relating to the success of process improvement initiatives
- Clear definitions, aggregation concerns, methods of collection, measurement repositories, and analysis techniques should all be part of a measurement program
- Usable, well-defined, relatively stable, measures are an essential part of achieving SW-CMM and/or CMMI Levels 4 and 5
- Many measures are inherently difficult to define (e.g. some productivity metrics)
- Like PPQA this PA matures in parallel with the organization
- If LIC has no intent to go to Level 4 activities, then this should be kept simple

Decision Analysis and Resolution (DAR)

- The purpose of Decision Analysis and Resolution is to analyze possible decisions using a formal evaluation process that evaluates identified alternatives against established criteria
- Specific Goals:
 - Evaluate Alternatives: Decisions are based on an evaluation of alternatives using established criteria
- Of negligible value to LIC?

Organizational Environment for Integration (OEI)

- The purpose of Organizational Environment for Integration is to provide an Integrated Product and Process Development (IPPD) infrastructure and manage people for integration
- Specific Goals:
 - Provide IPPD Infrastructure: An infrastructure that maximizes the productivity of people and affects the collaboration necessary for integration is provided
 - Manage People for Integration: People are managed to nurture the integrative and collaborative behaviors of an IPPD environment
- Again, if using basic model, this PA is not applicable

Questions??

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