MULTIPLE VIEWS OF CMMI APPROACH: A CASE EXPERIENCE

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Abstract

Software industries are rated as fast growing organization in the world. Indian software industries are exporting their product into various countries like USA, UK and Germany. Software Development process should be optimized to compete with world market. So that the companies can effectively deliver the product in time with required quality. CMMI is a model to optimize the development activity in every stage.

1. Introduction

In software development, three major components determine the quality of a product: the people that develop a software system, the technology that is employed by them, and the organization of the process of development [Arash Khodabandeh 1994]. The CMMI is a model for improving and appraising the performance of development organizations. It stands for "Capability Maturity Model Integration". It is published and developed by the Software Engineering Institute in Pittsburgh, PA. The CMM (the original version of the CMMI) was originally commissioned by the American Department of Defense to help them qualify software vendors' capabilities. From there it quickly evolved into a powerful tool to guide process improvement initiatives, not only for Software Development but for many related fields such as Systems Engineering, Product Acquisition, Team Management, Research and Development, etc.

Today the CMMI is used around the world in military, commercial and government organizations. It has been shown to reduce the risks associated with development projects, increase efficiency and improve the overall quality of products and deliverables.

Many civil industries such as transportation and telecommunications are making it a requirement for submissions to large tenders. Countries such as India and China are also using it to position themselves as dependable, trustworthy providers of world class outsourcing services.

The CMMI is best known for its five levels of organizational maturity. Each level represents a coherent set of best practices organizations are expected to implement as they become better at what they do.

Level 1: Initial (Majority of Organizations)
Level 2: Managed Process
Level 3: Defined Process
Level 4: Quantatively Managed Process
Level 5: Optimizing Process (less than 5% of Organizations)

To each maturity level are associated a number of related process areas. The process areas can be viewed as very detailed checklists of what goals need to be achieved, what activities performed, and what artifact created and maintained to satisfy the requirements for a specific part of the overall development process.

2. The Structure of CMMI

CMMI builds upon three key concepts: process areas, goals, and practices. Figure 1 illustrates the interaction of those structural elements. CMMI identifies 25 so-called process areas in the development process [SEI 2002]. Each process area defines a set of so-called specific goals and a set of specific practices that serve to fullfill the goals.

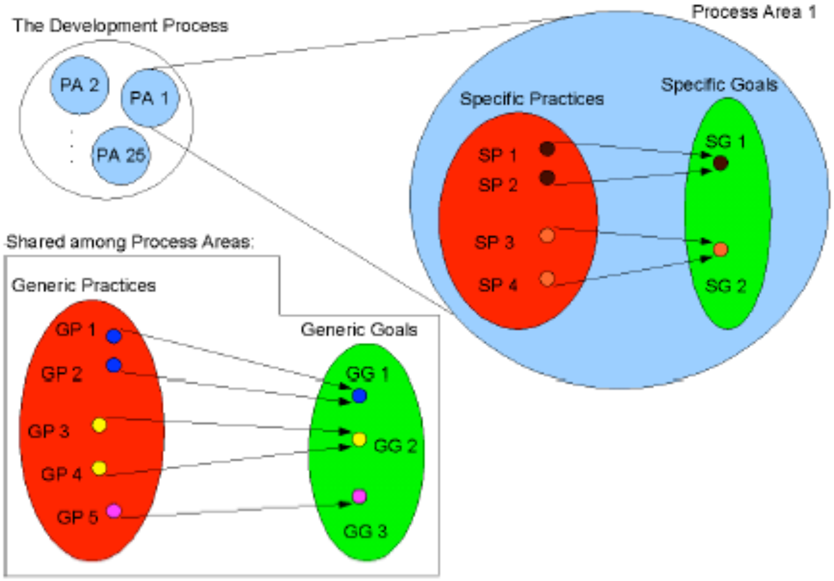


Figure 1. Structure of CMMI

Concerning process areas, it has to be pointed out that CMMI's process areas will most likely not map one-to-one on the processes of a certain organization. Thus, it is vital to determine the best mapping of processes to CMMI's process areas. This is a matter of interpretation.

3. Criticism of CMMI

As any other methodology for creating software, the CMM and CMMI have critics. Among the features criticized, the following two items seem to stand out:

- CMMI seems to favor large and bureaucratic organizations
- CMMI's exclusive focus on the process

Favoring the Very Large

This first point of attack is most likely caused by the fact that the SEI was sponsored by the U. S. DoD Governmental organizations are known for being large, bureaucratic bodies, promoting form over substance. Even Judy Bamberger, one of the key authors of the CMM, agrees that the CMM reflects the large, aerospace, contract-software development environment it was originally intended to address [Judy Bamberger 1997]. Thus, CMMI is undoubtedly easier applicable for measuring an organization's capability of fullfilling software Specifications rather than end user use-cases. It is also clear that CMMI needs less interpretation for a multinational corporation than a small software development studio.

Leaving Out the Rest

The second point of attack is that CMMI solely concentrates on the process as a factor in software development, sparing out people and technology. It is sometimes critized that CMMI promotes the process over all other issues (even over some core issues like coding software) and that implementing CMMI is thus no guarantee that a software project will succeed. The CMMI wasn't intended to be all things to all people or cover all possible aspects of software and system development [Judy Bamberger 1997]. CMMI deliberately focuses on the process and omits people and technology. But implementing CMMI can significantly raise the probability of success in a software process.

4. CMMI and Return on Investment (ROI)

There is no single, official “definition” of ROI – it can be calculated in many ways. Some of these includes such as

- Benefit/Cost ratio (considered as a ROI)
- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Payback Period (PP)/Break Even Point (BEP)

Return on Investment Examples

- Leading software organizations can reduce this Cost of Quality to 40% or less, resulting in 50% or more gains in productivity.
- Reduced cost of poor quality from over 45% to under 30%

  2:1 ROI over 3 years (Siemens Information Systems Ltd, India)
- Reduced software defects per million delivered SLOC by over 50% 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)
- Avoided $3.72M in costs due to better cost performance

  As the organization improved from SW-CMM level 4 to CMMI level 5 (Raytheon North Texas Software Engineering)

5. Typical CMMI Benefits Cited in Literature

Reduced Costs

33% decrease in the average cost to fix a defect (Boeing)

20% reduction in unit software costs (Lockheed Martin)

Reduced cost of poor quality from over 45 percent to under 30 percent over a three year period (Siemens)

10% decrease in overall cost per maturity level (Northrop Grumman)

Faster Schedules

50% reduction in release turnaround time (Boeing)

60% reduction in re-work following test (Boeing)

Increase from 50% to 95% the number of milestones met (General Motors)

Greater Productivity

25-30% increase in productivity within 3 years (Lockheed Martin, Harris, Siemens)

Higher Quality

50% reduction of software defects (Lockheed Martin)

Customer Satisfaction

55% increase in award fees (Lockheed Martin)

6. Critical Success factors of CMMI Implementation

The Critical Success factors are derived based on literature and case studies available in internet.

1. Compelling the Needs of the firm and employee
2. Senior management support and involvement
3. Software quality must be or be made to be - the top priority of senior management and ensure regular visibility of senior management sponsorship to the organization
4. Clear direction

   Develop the policies that can give clear direction
5. Measurable Goals

   Institutionalize organizational Process Improvement Goals

   - Process improvement goals must be defined and tracked at all levels of the Organization
   - Each management layer must behave as the process owner
   - Embed process improvement goals into the organizational goal setting process and instruments, such as Balanced Score Card and Management by Objectives

   Reduce the number of Goals in favor of Data Quality

   - Projects must be evaluated on a regular basis with internal assessments to see how well the policies are being followed
6. Focused and step wise implementation

Focus on the organization's ability to learn and change

- The organization will get used to the new processes. The rate of non-compliance adjustments will be detected with minimal delay
- The project team has the possibility to react to problems during deployment with minimal delay
- The potential of continuous improvements in the processes will be reported with minimal delay
- The steps are small and projects will be able to implement them
- A rhythm of change will be established and expected in the organization

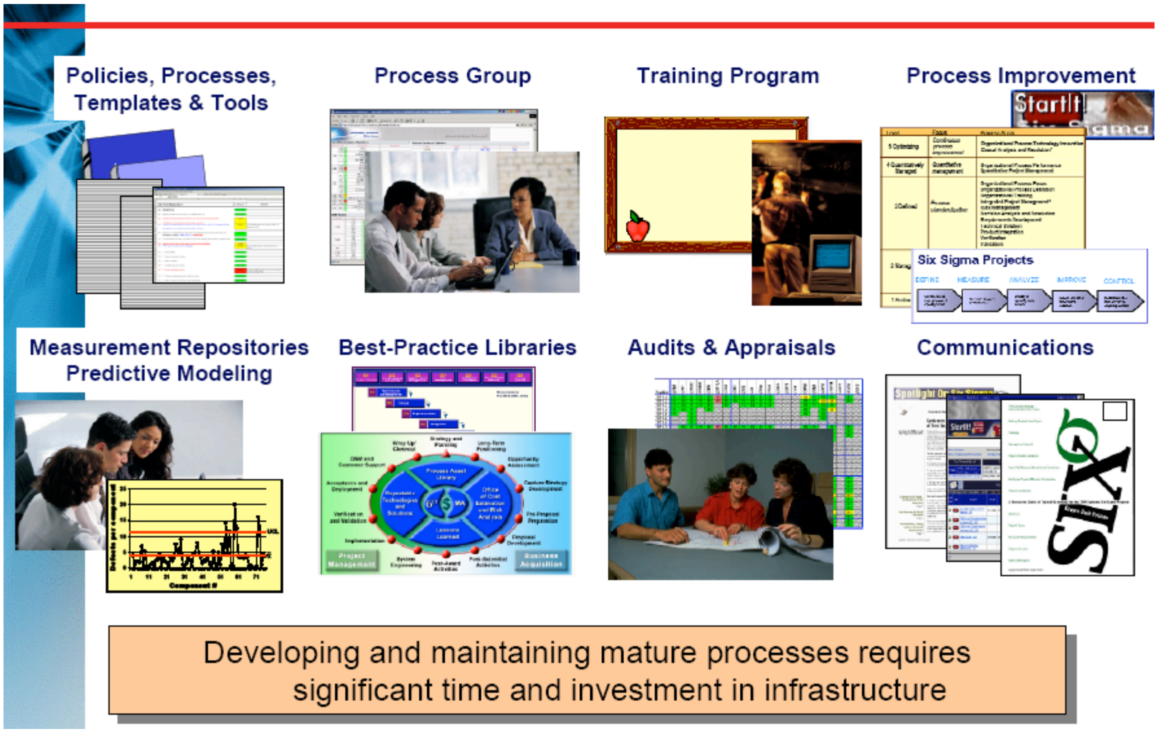
7. Communication with stakeholders
8. Define the Process architecture

   Practical implementation of the process architecture is typically a Process Asset Library (with Policies, Life-Cycle Models, Processes, Activities, Procedures, Roles, Templates for Work Products, Checklists, Guidelines, Training Material, Lessons Learned, PPQA Handbook, etc.)

9. SPI managed as Project with Rights and Duties
10. Train the people and provide right kind of resources

7. Organizational Infrastructure Required for CMMI Level 3

Figure 3 shows the various organizational infrastructure requirement to implement level 3 in medium and large scale organization



Developing and maintaining mature processes requires significant time and investment in infrastructure

Figure 3. Organizational Infrastructure Required for CMMI Level 3

8. Conclusions

Based on the discussion with various project managers, we conclude that organization capability to map with CMMI process area and how well the requirements are managed to deliver the product with high level of customer satisfaction drives the organization with high level of confidence to handle any kind of Projects.

References

Arash Khodabandeh and Paolo Palazzi (1994), ‘ Software Development: People, Process, Technology’ CERN - ECP Division Programming Techniques Group, Published in the proceedings of the CERN School of Computing, Sopron, Hungary and as CERN ECP Report 95/5.

SEI (2002), ‘The CMMI Overview’ by SEI. Available at http://www.sei.cmu.edu/cmmi/general/general.htm

Judy Bamberger(1997), ‘Essence of the Capability Maturity Model’, IEEE Computer Society.