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Comparative Study of Tangible and Intangible Benefits of CMMI to Selected Project, Product and Service-Based Organizations

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Abstract : Two decades after 1990 have seen many ups and downs in Software Industry in India. Companies have been making huge investments in process improvement in terms of time and money in process improvement models. Capability Maturity Model Integration (CMMI)-based process improvement is no exception. Many organizations are considering using CMMI whereas many are still skeptical about it. Considering the current meltdown situation across the world, companies are even more conscious about any investments in such models. It is difficult to quantify the value of such models. Evidence needs to be built for understanding the tangible and intangible benefits of CMMI to software industry. Current study is an attempt to understand the perception of selected software industries about benefits of CMMI. The study deals with impact of CMMI-based process improvement on issues like software quality, defect prevention, cost and schedule control, employees' confidence level and customer satisfaction in a comparative manner for project, product and service based select IT organizations. Current study becomes more important and relevant because of the fact that Software Engineering Institute (SEI) plans to release the CMMI-SVC i.e. CMMI guideline for service-based industry in March 2009.

Keywords: CMMI, Process Improvement, Software Quality Assurance

1.0 Introduction To The Topic

In the recent past, quality control activity has become increasingly important in software industries. On an average of project duration was being dedicated for quality control activities such as testing, inspections, reviews etc. Later on, the organizations realized that quality control, though essential, is extremely time and cost consuming. This further led to more emphasis on quality assurance activity. Moreover, organizations want to deliver software faster, better and cheaper. SW-CMM was one of the widely used models to map quality assurance activities. Some other models were also co-existing. But it was difficult to keep track of this array of models. Hence, it was in early 90s', it was thought that these models can be integrated to develop a more comprehensive model that will have positive features of then-existing models. CMMI team considered following models for integration:

1. The Capability Maturity Model for Software (SW-CMM) v2.0 draft C [SEI 1997b]
2. The Systems Engineering Capability Model (SECM) [EIA 1998][1]
3. The Integrated Product Development Capability Maturity Model (IPD- CMM) v0.98 [SEI 1997a]

These three source models were selected because of their widespread adoption in the software and systems engineering communities and because of their different approaches to improving processes in an organization.

CMMI is a model that facilitates process improvement through its structure, which is divided in to 6 levels as follows:

Level	Continuous Representation Capability Levels
Level 0	Incomplete
Level 1se	rvicePerformed-
Level 2	Managed
Level 3	Defined

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Level 4	Quantitatively Managed
Level 5	Optimizing

Capability Level 0: Incomplete

An "incomplete process" is a process that either is not performed or partially performed.

Capability Level 1: Performed

A capability level 1 process is characterized as a "performed process." A performed process is a process that satisfies the specific goals of the process area. Capability Level 2: Managed

A capability level 2 process is characterized as a "managed process." A managed process is a performed (capability level 1) process that has the basic infrastructure in place to support the process. Capability Level 3: Defined

A capability level 3 process is characterized as a "defined process." A defined process is a managed (capability level 2) process that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines, and contributes work products, measures, and other process improvement information to the organizational process assets. A critical distinction between capability levels 2 and 3 is the scope of standards, process descriptions, and procedures. Another critical distinction is that at capability level 3, processes are typically described more rigorously than at capability level 2. Capability Level 4: Quantitatively Managed

A capability level 4 process is characterized as a "quantitatively managed process." A quantitatively managed process is a defined (capability level 3) process that is controlled using statistical and other quantitative techniques.

Capability Level 5: Optimizing

A capability level 5 process is characterized as an "optimizing process." An optimizing process is a quantitatively managed (capability level 4) process that is improved based on an understanding of the common causes of variation inherent in the process.

CMMI-SVC (CMMI for service-based industry), guidelines that are expected to be released in March 2009, has 7 distinct areas exclusively considering the need of service industry. CMMI – DEV model, exclusively meant for developers, does not address following issues about service-based industry –

A.   Repetitive delivery over time

B.   Constant changes in customer requirements

C.   Low margins, competitive business environment, low overheads.

D.   Service continuity, service delivery

E.   Strategic service management

F.   Service transition

G.   Service system development

This is the reason why, CMMI-SVC draws some concepts and practices from service- oriented standards and models such as ITIL (Information Technology Infrastructure Library), ISO/IEC 20000: Information Technology – Service Management, Control Objects for Information and related Technology (CobiT) and Information Technology Services Capability Maturity Model® (ITSCMM)

2.0 Need for research

Service organizations comprise of 80% in India. Currently some service organizations are applying CMMI for development and service delivery. BPO, telecom, IT, Hospitality, Healthcare are some of service sectors which are deploying CMMI.

Considering the increasing complexity in software field and the time and monetary investment for projects, it becomes essential to predict long-term and short-term benefits that an organization can get. Though, it is difficult to quantify the benefits earned through CMMI-based process improvement, some indicators can be used to evaluate the benefits. Further, it is a perceptive view that benefits achieved through CMMI based process improvement to project, product and service-based organization differ in many ways. Following are some indicators that are being considered in the current study:

1. Cost of quality (COQ) – Amount spent on prevention, appraisal and removal of defects is called as cost of quality.

2. Schedule control – Achievement of milestones as per the agreements with the customers

3. Defect density – Number of defects per unit of software module

4. Query Response Time – Time required for solving customer queries.

5. Improved level of discipline – Increase in level of discipline in the tasks performed by employees.

6. Improved productivity – Increase in the level of effectiveness and efficiency of the tasks performed by employees.

7. Customer satisfaction – Level of fulfillment of customer expectations.

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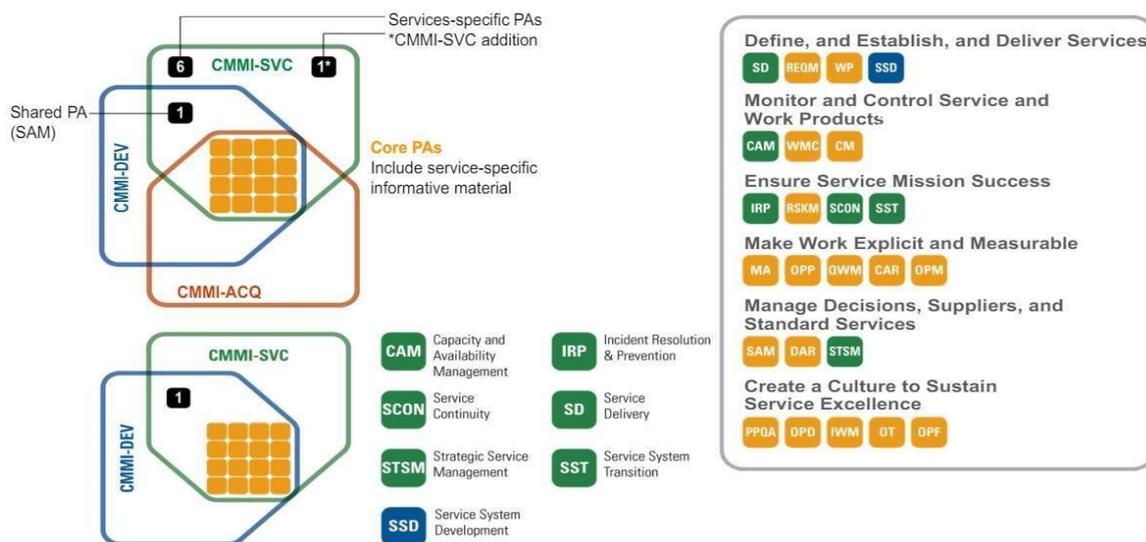
Source: https://insights.sei.cmu.edu/documents/2959/2012_017_001_22739.pdf

Service providers need a consistent benchmark for process improvement that aligns with their work and is based on a proven approach.

- The demand for process improvement in services is expected to increase, as services make up more than 80% of both the U.S. and global economies.
- CMMI-SVC meets the needs of various service types by focusing on common processes.
- Many existing models are tailored to specific services or industries.
- Other models lack a clear improvement path.
- Poor customer service costs companies $338 billion annually.
- Services account for more than 54% of the U.S. DoD's acquisitions.
- SEI stakeholders have requested a model specifically for services.

3.0 Research Methodology

3.1 Objectives

a. To study and compare the tangible and intangible benefits of CMMI to project, product and service-based organizations

b. To study process areas in CMMI-SVC and its compatibility for services

c. To identify and study critical success factors in CMMI implementation in service- based organisations.

3.2 Sample selection

Case study method has been used to collect information about CMMI projects in 3 IT organizations in Pune. One each under the categories – Project based, product based and service based. Organisations with acquaintance with the researchers have been selected for research.

3.3 Data Collection

"One of the greatest strengths of the qualitative approach is the richness and depth of explorations and descriptions.", Myers (2000[2]). The study under consideration uses the method of data collection through case study method.

3.1 Primary Source – Primary source of information is personal interactions with QA heads and CMMI managers in IT organizations. 27 QA professionals with interviewed with structured interview, with open ended questions.

3.2 .Secondary Source - Secondary data has been collected through case studies published on www.sei.cmu.edu Also, other research papers published in the same area in refereed journals have been used as references. A CMMI guideline published on the Software Engineering Institute's site is a major source for conceptual references.

4.0 Major beneficiaries

Very few service organisations in India have used CMMI for process improvement. Further, they have been able to go up-to level 3 with difficulty. But, considering the success of CMMI for project-based organizations, it can be extended to cater the needs of service-based organisations. Organisations on the verge of commencement of CMMI projects can refer to the conclusions of the research work for fine tuning their efforts towards process improvement.

5.0 Data analysis and conclusions

CCMI SVC helps to set process improvement goals and priorities, provide guidance for quality processes, and

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provide a point of reference for appraising current processes • It can be applied internally or externally

• It works well with other frameworks

• It represents the consensus of thousands of practitioners about the essential elements of service delivery • It can be used in whole or in part In defense sector (name confidential)

- 58% fewer hours needed to repair defects for ML5 versus ML3; Result: a potential cost savings of $1.9 to $2.3 M per average-sized project for CMMI ML5 relative to the SW-CMMI ML3 baseline Defect find and fix cost down 22% - Effort hours needed to repair high severity defects in integration and test phases 24% reduction in effort hours per defect

- Cost performance index Increased from .88 to .96 over two years

- Overhead rates for CMMI ML5 relative to the SW-CMMI ML3 baseline Reduced by 7.3%

- Software development cost for CMMI ML5 relative to the SW-CMMI ML3 baseline Reduced by 28% Consultancy services

- Increased productivity.

- Reduced costs by minimizing non-essential use of resources and avoiding generating defects.

- Enhanced customer satisfaction with the ability to consistently deliver your products or services.

- Improved and more predictable delivery time with decreased project delays. Software development

- CMMI helps deliver software products that meet or exceed cust omer expectations and requirements,

- prevent defects, errors, and rework by applying best practices and standards throughout the software lifecycle - streamline and optimize the software processes,

- eliminate waste and redundancy, foster a culture of continuous improvement and learning from data and feedback

- demonstrate the organization's commitment to deliver high-quality software products and services.

To summarize, we can conclude that Tangible Benefits

• Project-Based Organizations: Improved project delivery timelines, reduced defects, and cost savings.

• Product-Based Organizations: Enhanced product quality, increased innovation, and market competitiveness. □

• Service-Based Organizations: Better service delivery,increased customer satisfaction, and reduced operational costs. Intangible Benefits

• Project-Based Organizations: Enhanced team collaboration, improved risk management, and stronger client relationships.

• Product-Based Organizations: Increased employee morale, better strategic alignment, and improved brand reputation.

• Service-Based Organizations: Enhanced process transparency, stronger organizational culture, and greater adaptability to change.

6.0 Bibliography and References

[1] Elm 2007, Joseph P. Elm, Dennis R. Goldenson, Khaled El Emam, Nicole Donatelli, & Angelica Neisa. A Survey of Systems Engineering Effectiveness: Initial Results. (CMU/SEI-2007-SR-014). Software Engineering Institute, Carnegie Mellon University, 2007. http://www.sei.cmu.edu/publications/documents/07.reports/07sr014.html

[2] Glazer 2008, Hillel Glazer. Hillel Glazer's Blog, Agile CMMI Blog. 2008. http://www.agilecmmi.com

[3] Forrester 2008, Eileen Forrester. CMMI for Services (CMMI-SVC) Overview Presentation

[4] Lawlis, P.; Flowe, R.; & Thordahl, J. "A Correlational Study of the CMM and Software Development Performance." CrossTalk 8, 9 (September 1995): 21-25.

[5] Hefner 2005, .Rick Hefner. Achieving the Promised Benefits of CMMI, Director, Process Initiatives Northrop Grumman Corporation, Presentation

[6] Diaz, M., and J. King. "How CMM Impacts Quality, Productivity, Rework, and the Bottom Line." crosstalk ,Mar. 2002 <www.stsc.hill.af.mil/cross talk/2002/03>.

[7] Unlocking Success with CMMI: The Benefits and Importance of Capability Maturity Model Integration (CMMI)Availableonhttps://visuresolutions.com/cmmi-guide/benefits/#:~:text=Advantages%20of%20CMMI%20Implementation,Heightened%20Productivity%20and&text=CMMI%20promotes%20process%20standardization%20and,achieve%20more%20with%20fewer%20resources.

[8] https://www.sei.cmu.edu/search.cfm#stq