Improving Organizations Efficiency through CMMI and IDEAL

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In this paper we present the characteristics of the CMMI process model and the IDEAL implementation frameworks that have appeared from the need to address generic company-wide organizational issues for a broader range of activity domains.
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Introduction

In an attempt to improve the way organizations and companies organize and do business, many models, standards and methodologies have been developed. Unfortunately, the majority of these models are meant to improve specific activities for specific organizations only and do not take a systematic approach to the general problems that most organizations are facing.

In an attempt to minimize the aforementioned problems is where CMMI comes in with general guidelines and models that transcend disciplines, addressing the entire product life cycle from conception, development, delivery and maintenance. Moreover, the model is conceived as a core, onto which further extensions can be added. However, as the CMMI is not concerned with and provides no implementation directions, the IDEAL model comes in to complete the picture

Process Models

There are several dimensions an organization can focus on to improve its business. The three critical dimensions that organizations typically focus on - people, procedures and methods, tools and equipment - are hold together through the processes used in the organization.

A process is defined by IEEE as “a sequence of steps performed for a given purpose”. As the CMMI model puts it, evaluating the efficiency of an organization can be reduced to evaluating the efficiency of its processes, and introduces as a measure of an organization’s efficiency the maturity levels.

A process model is a structured collection of practices that describe the characteristics of effective processes. It provides its users with a common language and a shared vision.

Capability Maturity Models

Capability maturity models (CMMs) focus on improving processes in an organization. They contain the essential elements of effective processes for one or more disciplines and describe an evolutionary improvement path from ad hoc, immature processes to disciplined, mature processes with improved quality and effectiveness.

The CMM Integration project was formed in order to outrun the problem of using multiple CMMs. The intent of CMMI is to provide a CMM that covers product and service development and maintenance but it provides an extensible framework so that new bodies of knowledge can be added.

A process area is a cluster of related best practices in an area that, when implemented collectively, satisfies a set of goals considered important for making significant improvement in that area.

For systems engineering, the CMMI identifies 22 theoretical process areas, as represented in table 2. In the case of software engineering organizations, the process areas listed for systems engineering remain the same. The only difference in the CMMI model is that the discipline amplifications for software engineering receive special emphasis.

CMM Approaches: Representations

The CMMI model provides its users with two approaches to process improvement; these are the so-called “model representations”, which can be thought of as two different views of the same data, which is the CMMI model.

The **continuous representation** offers a detailed image of an organization’s processes.

It will allow an organization to evaluate process areas individually, and it is the representation commonly used in process improvement, because it allows identifying and focusing on trouble spots, and measuring improvement progress on a finer-grained scale.
For each process area, capability levels are used to measure the improvement path from an unperformed process to an optimizing process. Capability levels cannot be skipped, and are built one on top of another: the capability level X contains inherently the requirements of the capability level X-1. The first capability level, CL0 contains no requirements, but it is rather defined by the lack of any of the performance characteristics required at the first appraisable capability level. The last capability level, CL5 can be seen as an assurance for lasting, continuous self improvement in that specific process area. The CMMI's six capability levels are: 0 – Incomplete, 1 – Performed, 2 – Managed, 3 – Defined, 4 - Quantitatively Managed, 5 – Optimizing.
Using the continuous representation implies a good understanding of dependencies among the process areas, since the intrinsic interconnections between them might require a certain capability level for another process area before another one reach a targeted capability level. Table 1 represents the process areas in the continuous representation. [ChKo03]

Table 1. Continuous representation

Category	**Process Area**
Process Management	Organizational Process Focus (OPF) Organizational Process Definition (OPD) Organizational Training (OT) Organizational Process Performance (OPP) Organizational Innovation and Deployment (OID)
Project Management	Project Planning (PP) Project Monitoring and Control (PMC) Supplier Agreement Management (SAM) Integrated Project Management (IPM) Risk Management (RSKM) Integrated Teaming (IT) Integrated Supplier Management (ISM) Quantitative Project Management (QPM)
Engineering	Requirements Management (REQM) Requirements Development (RD) Technical Solution (TS) Product Integration (PI) Verification (VER) Validation (VAL)
Support	Configuration Management (CM) Process and Product Quality Assurance (PPQA) Measurement and Analysis (MA) Decision Analysis and Resolution (DAR) Organizational Environment for Integration (OEI) Causal Analysis and Resolution (CAR)

This representation organizes the process areas from a lucrative point of view in four basic categories. Support category contains processes that do not have an external / commercial output, but provide the foundation on which the rest of the organization can perform an efficient activity. Engineering category contains processes that "do the work" - perform the actual work of the organization. Project Management contains processes that coordinate to efficiency the "actual work" of the organization. Process Management contains processes that set paths for the entire organization.
The **staged representation** offers a view at the organization level, providing a measure for the entire organization. It is less detailed than the continuous representation, but it

provides a higher-level view of the entire organization, and a simple, straightforward, easily understandable label, with more direct commercial / business implications. The staged representation will provide as a standardized measure the entire organization's maturity level.

Just as processes capability levels, the maturity levels are build one on top of each other, so a level cannot be "skipped", and a superior maturity level has, intrinsically, the maturity requirements of the inferior maturity levels. As a difference, the first level in the staged representation is maturity level 1 – ML1, but the concept behind the first level stays the same: this first level is rather characterized by a lack of complying with the requirements of the first appraisable maturity level. The maturity levels are represented in Table 2.

Table 2. Maturity Levels in the Staged Representation

Id	Level	Focus	Process Areas
5	Optimizing	Continuous Process Improvement	OID, CAR
4	Quantitatively Managed	Quantitative Management	OPP, QPM
3	Defined	Process Standardization	RD, TS, PI, VER, VAL, OPF, OPD, OT, IPM, RSKM, IT, ISM, DAR, OEI
2	Managed	Basic Project Management	REQM, PP, PMC, SAM, MA, PPQA, CM
1	Initial		

There is a strong relationship between the two representations, not only in terms of levels naming. Any maturity level implies that in the continuous representation a group of process areas have reached certain capability levels

The staged representation offers a roadmap to efficiently focus on improving process and process areas, with milestones for bringing the entire organization in a coherent and uniform way from the initial level to the optimizing level, ensuring a robust incremental improvement. Achieving a maturity level sets a solid basis for the entire organization improvement towards the next maturity level.

The staged representation is seen also as a good choice when starting a process improvement initiative lacking precise directions towards the areas that need improvement. More than a decade of research and experience in the software community has shown that this is the enduring path to be followed when improving organization-wide. Table 2 represents the process areas in the staged representation [ChKo03].

The IDEAL way

However, the **CMMI** model provides a framework for an efficient process structuring inside an organization, but it provides no directions related to the actual implementation. A whole set of new issues, from a different perspective, had to be addressed, and the **IDEAL** model provides a usable, understandable approach to process improvement by outlining the steps necessary to establish a successful improvement program. The **IDEAL** model, as shown in Figure 1, provides an iterative framework for implementing a process improvement project.

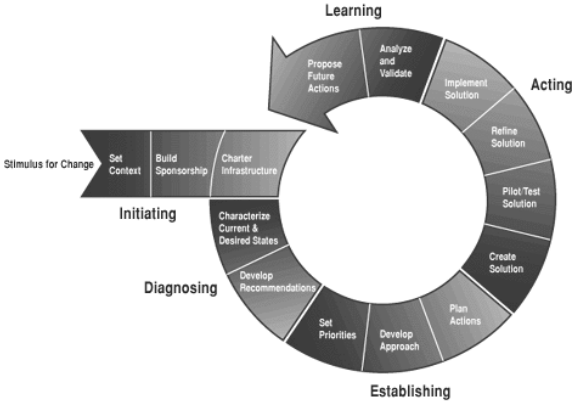

Figure 1. The **IDEAL** Model [CMSE2]

The **IDEAL** model consists of five phases [CMSE2]:

I – Initiating: Laying the groundwork for a successful improvement effort.

D – Diagnosing: Determining where you are relative to where you want to be.

E – Establishing: Planning the specifics of how you will reach your destination.

A – Acting: Doing the work according to the plan.
L – Learning: Learning from the experience and improving your ability to adopt new technologies in the future.
Each of the five phases is made up of several activities.
The **Initiating** phase is concerned with the preliminary activities that create the proper context for improvement. It implies determining the stimulus for change, the objectives, the consequences on the business processes and the expected benefits, obtaining the sponsorship for the process improvement project, and setting up a mechanism for managing the implementation details. The **Diagnosing** phase focuses on developing a more complete understanding of the improvement work, determining more accurately the current position, through a CMMI point of view, in correlation with the desired destination, also defined in CMMI terms. The **Establishing** phase provides the process improvement project with a roadmap, planning the needed steps in achieving the desired goals. This is formalized in a detailed work plan including specific actions, milestones, deliverables and responsibilities. Issues from the plan are followed accordingly in the A**cting** phase. A "best guess" solution is put together and tested through a pilot test. The results from the pilot are used to refine the solution in several iterations and then implemented. The L**earning** phase implies taking advantage of the accumulated experience. An analysis on how the intended purposes were achieved and what could have been done more efficient is put together, and lessons learned are documented. Based on this, proposals for future change implementations are issued and documented for the appropriate management levels to take into consideration. Upcoming iterations will use the outputs of the previous **Learning** phase for further improving the implementation process.

Conclusions

CMMI provides an interconnected and hence stable model, with more detailed coverage of the product life cycle than other process-improvement alternative products. CMMI assimilates the experience of an entire community, and many lessons learned during the development, maintenance, and usage of the source models from which it was developed, addressing some problems found, for example, in both the Software CMM and the SECM. CMMI allows for flexibility in implementing, keeping the focus on organization's business objectives, providing organization-wide common terminology, architecture, and appraisal methods.
IDEAL, initially built on the model of a software development lifecycle, now provides a generic simple iterative implementation model for CMMI.

References

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