

PILOTING SOFTWARE ENGINEERING INSTITUTE'S SOFTWARE PROCESS IMPROVEMENT IN INFORMATION SYSTEMS GROUPS

Donald R. Chand
Bentley College, Waltham, MA 02452, USA

Keywords: Capability Maturity Model (CMM), Software Engineering Institute (SEI)

Abstract: Although the capability maturity model has become an accepted basis for software process improvement in software organizations, its diffusion in IS organizations continues to be slow. This paper describes the experience of piloting the Software Engineering Institute (SEI) process improvement with six different information systems (IS) groups. It brings out the perceptions and reactions of IS developers and the assessment team regarding the SEI approach. This case study shows that the typical organization structure of IS organizations seems to impede the successful implementation of CMM-like improvement effort. More significantly, it appears that the CMM-based production process view of software does not match the product development view of IS work.

1 INTRODUCTION

Although the motivation for CMM (Capability Maturity Model) was the Federal Government's need for a method of objectively and consistently assessing the ability of potential Department of Defence (DOD) contractors to develop software in accordance with modern software engineering practices, CMM has evolved as an approach for improving the software development capability of a software organization. Today the value of CMM model is well accepted and established in software groups and software engineering organizations both globally and in all sectors of the economy. Results of case studies reported in the literature shows that CMM-based software process improvement (SPI) efforts substantially improve quality, cycle time and productivity. Yet, CMM improvement efforts have been slow in diffusing in IS organizations. For example, there are no successful stories of CMM implementations in IS organization comparable to Hugh Aircraft, Raytheon or Schulumberger. Failed attempts of CMM implementations at leading organizations like Fidelity and Digital Corporation are not discussed or known. Even the successful achievement of CMM level 3 at John Hancock's IS groups encountered serious setbacks and difficulties.

Thus there is a need to understand why CMM-based improvements have failed to diffuse in IS organizations. Using the insights gained from piloting the SEI improvement process at the Information Management and Technology (IM&T) division of Digital Corporation, this paper extrapolates the factors that appear to impede the acceptance and success of the CMM-based SEI improvement process in IS organizations.

2 PROJECT BACKGROUND

In the nineties, the SEI maturity improvement process was an integral part of Consulting Services of Digital Corporation. The aim of this program was to improve the performance of software consulting groups to make them competitive in the industry. At that time, the IM&T division was Digital's internal IS organization responsible for serving the technology and systems needs of Digital workers worldwide. Since IM&T projects and groups were similar to the consulting services groups, namely, they are often small and their projects usually run less than a year, it was decided to port the Consulting Services/SEI improvement process to the development groups in IM&T.

A four-member project team was established to

pilot the SEI improvement process in six business applications development groups within IM&T. Since the CMM road map is complemented with a well-defined SEI improvement process, the team was trained in the SEI assessment process. Because the management structure of SEI targeted organizations is different from that of a typical IS organization, the team devised a simplified assessment process that followed the SEI improvement process very closely, differing only where an advantage was obvious.

3 PILOT EXECUTION AND RESULTS

3.1 Overview phase

We followed the SEI process for the overview phase by making a one-hour presentation to each management team of the six IS groups selected for piloting the SEI improvement process. During our presentation, we conscientiously solicited the comments and participation of the management teams of the six groups. The six groups were in three different functional areas of IM&T. The four managers in the first functional area were generally receptive to the idea of improving the software development process, and because we sought feedback they pointed out that the SEI process is missing areas important to IS groups such as corporate data management and requirements gathering. Despite this, they were willing, in varying degrees, to participate in the pilot. Two of the managers in this functional area wanted us to lead the assessment and identification of opportunities. The other two committed their groups to doing the entire assessment process at least through creating an action plan.

Within the second functional area they were already using a process coaching team approach with a software team working on a critical application. This project ran parallel to the process-coaching project. Two members of our SEI process improvement team were consultants on the process-coaching project.

In the third functional area, we made the initial presentation to a technology group that wanted to be the change agents within the larger organization. This seemed like an interesting way of accomplishing change, but other priorities intervened for that group and this project did not materialize.

3.2 Team assignment phase

This phase begins with a kick-off meeting, where the entire group is introduced to the SEI's improvement program. After the kick-off meeting, the process team is selected. It was difficult for some managers to assemble their whole group within the time frame of the study because many staff members were geographically distributed in different States. For two teams we had to begin the process team formation step before holding the kick-off meeting.

It took a significantly long time to appoint some process teams. With two groups, there was also a significant wait for the team members' time to free up so they could begin the work. There were other delays during the work. These were due to business pressures, and, in one case, due to illness.

The target groups averaged about 10 members, and we worked with two team members from each group. Half the participants were not senior and/or experienced software developers, although they were always people who had expressed interest. Most were knowledgeable about the process, and one was a group manager.

3.3 Assessment phase

The procedure we used involved distributing to each process team member a copy of the Assessment Questionnaire and the score sheet, a copy of the accompanying glossary of terms, and a copy of the follow-up questions to be used during the validation phase. We read and explained each assessment question to the process team so that there is one interpretation of a given question. All groups rated themselves in the first level, below the second quartile. In the SEI scoring process, third-level and above software engineering practices do not count unless the group has already achieved the second level. We did find that every group had one or two level 3 or level 4 practices in place.

We observed that there was widespread concern that IM&T or their own managers, would try to use this as an evaluation tool.

Several team members provided thoughtful comments on the contents of the Assessment Questionnaire, as had their managers during the overview phase. Most groups observed that the SEI assessment instrument does not cover the full range of IM&T activities. They identified the missing areas in the SEI questionnaire as interaction with business, organization considerations, implementation management, personnel issues, and audit function.

3.4 Opportunity selection phase

The purpose of the opportunity selection phase is to identify and select which software engineering practices the software group will improve. In the SEI process, only those questions that would advance the organizations to the next higher level are considered as opportunities. In our pilot study, since all six groups were at level 1, copies of the level 1 questions with "no" answers were sent to each software developer in the group. In preparation for the next meeting they were asked to rank each question from 1-5 in both cost and benefit to the group, and also to give a brief rationale for their cost/benefit ranking.

The results of this ranking were graphed in a scatter diagram with benefits along the x-axis and cost along the y-axis. The primary opportunities to focus were in the lower right quadrant, indicating the highest benefit and lowest cost. Opportunities outside but near this quadrant were marked as secondary opportunities and they were discussed at the meeting. Since all groups ranked themselves at level 1, only 33 level 2 questions that received "no" answers questions were considered as opportunities. Four groups reached the stage of selecting opportunities for their groups to undertake. One group had elected not to go further with an action plan, but they presented the results to a staff meeting. One group selected opportunities and when the project closed, that group was working on implementing improvement plans. Another group was still working on selecting opportunities when the project closed.

Opportunities were selected according to the group's perception of what was most lacking in their development process. The choices varied widely, from standard cost estimates, project management to regression testing practices.

The fourth group did not select any opportunities, rejecting all the questions as being not relevant to the way their organization currently has to do business. Their work is mostly maintenance, enhancements and changes to a legacy system written in MUMPS. Their process is informal, based on arbitrary deadlines imposed by their customer community.

3.5 Validation phase

We asked to see backup material and sought evidence in specific current projects. In addition, we interviewed the developers in the group. The purpose was to confirm the practices that received a "yes" are in actual use. One group completed the validation phase.

3.6 Action plan phase

The purpose of the action plan phase is for the process team to prioritize the opportunities and create an action plan. In the pilot study, we encouraged the process groups to incorporate as many changes as would be practical to undertake. One group in this study reached this stage.

4 IS PERCEPTIONS OF CMM

The IM&T managers and developers felt that

- SEI assessment process is valuable
- CMM does not cover key IS development activities
- CMM is too bureaucratic and rigid
- CMM does not address the true needs of IS development

SEI Assessment Process is Valuable

The SEI process was well received by the IS managers. Most recognized the need to change and felt that it would help improve the way they did their job. The groups saw benefits from exposure to SEI approach. They felt that just going through the Assessment Questionnaire process generated awareness, ideas and discussion that was very valuable.

CMM is Not the Whole Solution

Nearly all groups told us that CMM does not address the full spectrum of IM&T activities. For example, preparing the business partner for work changes, training the user community, discussing and implementing changes in the user process, and analyzing the project after conclusion are considered part of the software development process. Furthermore, in IM&T, audit of the tools, methods and work activity is common. There is no reference to a DP auditing group outside the development group in the SEI process.

Lastly, they felt that most of their work involved constant interaction with the customer maintaining and enhancing existing systems and that activity is not covered in the SEI approach. Specifically, in the SEI questions the customer is mostly missing. IM&T customers are responsible for sponsoring the product, negotiating the requirements, setting the project scope, and specifying the interfaces.

CMM is bureaucratic and rigid

A few of the key process areas of level 2 do not apply to IS work such as managing subcontractors, and requiring organizations to achieve level 2 KPA before working on level 3 KPA is too rigid. Also,

the idea of separate SEPG and SQA function was viewed to be bureaucratic.

CMM does not address the true needs to IS work

Most groups felt that in SEI work it is not clear whether small enhancement projects and maintenance work is included in the realm of software development. In IM&T activities, one group estimated that 20% of the work is new development and 80% is maintenance effort.

It was pointed out that personnel turn over is common. Most groups are not up to full headcount. When a person leaves, work is re-ordered but invariably some work just is not done.

5 OUR LEARNING

As members of the process assessment team we learned that

- CMM is flexible
- Management commitment is more than management agreement
- Matrix reporting is a barrier to improvement initiatives
- Organization stability is necessary
- IS development is different from software development

CMM is flexible

Although all the groups were at level 1, their most pressing concerns were different. We found that the SEI model is flexible in allowing each organization to choose what is most important to them.

Management commitment is more than management agreement

SEI process emphasizes that any improvement project must have top-management support and backing. Apparently, we did not build the full management support for the pilot effort. As a result, we did not feel that there was sufficient support from the IS managers, beyond an initial pep talk an occasional remote prodding. Part of the problem was that we did not communicate what was expected from them. We know now that it is important to explain to the top management what commitment and readiness really means.

Matrix reporting is a barrier to improvement

Most groups in IM&T report to two or more organizations. One is the IM&T headquarters and the other is at least one business unit. They take directions from each and attempt to satisfy some median, usually resulting in mediocre performance. The priorities of the business partner and IM&T are

often not aligned. For example, IM&T may mandate to downsize at the same time when the business partner needs a critical information system. Improvement requires consistent directions, and conflicting directions makes improvement extremely unlikely.

Organizational stability is necessary

When this pilot project was executed, the IM&T organizations were not stable. Every organization that we came into contact during this period was in the process of re-organizing. They had new managers, new colleagues, new structures, new work, and new locations. In many cases there had been more than one re-organization within a year. One organization reorganized three times in the six months between our first overview presentation and the closing of the project.

Resources were reduced often, leaving fewer resources to do the existing work, and often none to implement the improvement effort. As a consequence, process improvement became low priority, placed on the back burner, and the improvement projects were not completed.

IS development is different from software development

The CMM-based SEI approach views software development as a task-driven, structured effort driven by known and pre-specified ordering of the requisite tasks. Therefore, people roles are task-specific, discrete, specialized and identifiable. In IS work, the production processes are secondary to product and the development effort takes place through the network ties developed by the developers, users, vendors and customer. In the SEI paradigm, good process produces good product, in the IS paradigm good product comes from having good people. Because the SEI process has a production process view of software, it does not match the product development view of IS.

REFERENCES

- Paulk, M.C., Bill Curtis, M. B. Chrissis and C. V. Weber, "Capability Maturity Model, Version 1.1, *IEEE Software*, July 1993, pp. 18-27.