

Strengths and Weaknesses of Maturity Driven Process Improvement Effort

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Abstract

In the recent decades most of the big organizations have adopted maturity driven process improvement efforts (MDPI). Most of these efforts have been inspired of maturity models like the CMM (Capability Maturity Model). The maturity of an organization's processes is measured through its maturity level. An organization availed a high maturity level is considered more trustworthy. In this competitive business era making software process improvement (SPI) happen is a challenge for small organizations. The statistics provided by Software Engineering Institute (SEI) for software community striving for SPI by using CMM/CMMI indicates that a large number of companies fail to achieve their process improvement goals. SPI efforts have mostly been prolonged, expensive, and not often delivered the effects back to the organizations in the same dimension as investigations. We wonder WHY? This research paper investigates strengths and weaknesses of maturity driven process improvement (e.g. CMM). The case studies in extant SPI literature are studied and focus group is used for data Collection. The study suggests that process improvement initiatives should be tailored addressing organizational needs instead of blindly pursuing maturity models prescriptions. Furthermore, it is suggested to have an inception phase prior to an SPI initiative to decide whether a maturity driven process improvement approach should be opted or an effect driven process improvement approach.

1. Introduction and Background

This section gives an introduction to this paper. Section 1.1 describes the purpose, whereas Section 1.2 presents the

problem formulation and derived research questions; Section 1.3 describes the scope of the paper.

In this present era it has emerged as a fact that no software organization can stay in the business competition without improving its processes. Most of these efforts have been inspired of maturity models like the CMM (Capability Maturity Model) and been guided by the area of Software Process Improvement (SPI). In this sense for an ad hoc organization with no experiences of doing SPI and CMM the efforts have mostly been prolonged, expensive, and not often delivered the effects back to the organizations in the same dimension as expected.

1.1. Purpose

The purpose of this paper is to describe the strengths and weaknesses of maturity driven process improvement focusing on CMM.

1.2. Research Question

The research is conducted in order to answer the following research question:

“What are the strengths and weaknesses of maturity driven process improvement efforts?”

1.3. Scope

This paper is limited to the maturity driven process improvement focusing on CMM, providing brief description about SPI and CMM and describing weaknesses and strengths of maturity driven process improvement.

2. Literature Study

The enhanced computerization of society has made software quality a critical subject in present era. The attainment of better software quality directly depends on mature software processes. Moreover, only mature processes could give an edge to an organization in the current business competitive era [1]. Due to these facts; SPI has been widely used as a systematic approach to improve organizational capabilities [2]. Consequently, several process improvement methodologies and models have been introduced, e.g. CMM, CMMI, Software Process Improvement and Capability dEtermination (SPICE), Agile Methodologies and Six Sigma etc. [3].

When an organization decides for an SPI initiative then generally faces up two questions: what to improve and how to improve? including methodologies like QIP and IDEAL and so on.

What to Improve?

SPI models like CMM, and ISO helps on what to improve. These models provide a set of goals in terms of processes to be achieved in order to attain certain certification or maturity level. We picked CMM to elaborate the concept of maturity driven process improvement. The rationale for choosing CMM is due to its wide spread adoption as process improvement model in software community.

In early 70's Philips Crosby proposed 'maturity grid' [4]. IBM further developed it as 'process grid' [5]. Watts Humphrey adopted IBM's process grid to software processes and introduced maturity levels into it and named it as 'process maturity grid' [6]. This 'process maturity grid' was transformed into software process maturity framework. It was evolved by modifications in Key Process Area (KPA's) at different maturity levels and finally came up as the capability maturity model (Figure1, CMM-SW) [6].

Initial: Any organization having no processes is by default on 'initial' level.

Repeatable: The processes used repeatedly. It consists of six key process areas. i.e. Software Configuration management, software quality assurance, software subcontract management, software project tracking and oversight, software project management, and requirement management.

Defined: The processes are defined as standard process. It consists of seven key process areas, i.e., peer reviews, intergroup coordination, software product engineering, integrated software management, training program, organization process definition, and organization process focus.

Managed: There are two key process areas at this level, i.e., software quality management, and quantitative process management.

Optimizing: It prescribes three key process areas, i.e., pro-

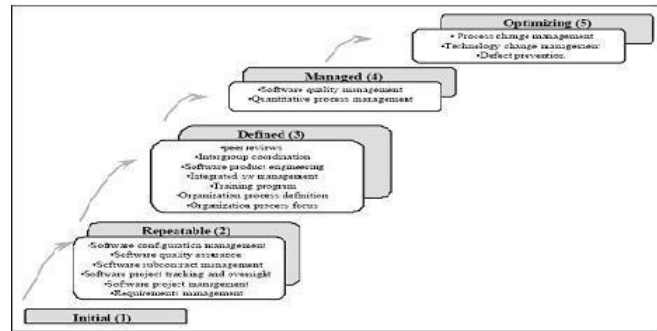


Figure 1. The CMM Model and the Five Maturity Levels (Paulk 1993)

cess change management, technology change management, and defect preventions.

CMMI has been released by SEI that has extended CMM's practices [8]. Mainly CMM focused at software engineering whereas CMMI has integrated system engineering with software engineering. It consists of five maturity levels i.e. initial, managed, defined, quantitatively managed, and optimizing. In total 34 KPA's are there.

How to Improve?

There are some methodologies like IDEAL, and QIP to address the question "how to improve" or more specifically "how to run an SPI project". IDEAL model was introduced by SEI in mid nineties. This model provides guidance for the implementation of SPI. It runs SPI project in a cyclic way. It mainly consists of five different phases 1) Initiating, 2) Diagnosing, 3) Establishing, 4) Acting, 5) Learning

Initiating: This phase focuses on initiating the process, it includes plans and schedules.

Diagnosing: This phase concentrates on diagnosing the current maturity level of organization.

Establishing: This phase focused on the information gained from previous phase and then prioritizing the actions.

Acting: In this phase solution is implemented.

Learning: The last phase focuses on lessons learned from software process improvement cycle or previous phases.

3. Method

This section explains research methodology. The research effort is started with building basic understanding of SPI. How an SPI project could be conducted and the strate-

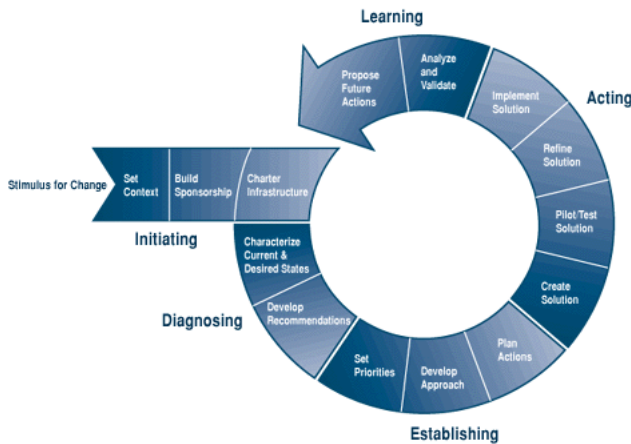


Figure 2. The IDEAL Model for SPI (Mc Feeley 1996)

gic approach to meet SPI goals like IDEAL model (see figure 2). After building conceptual background of SPI implementation; we further selected few case studies in extant SPI literature. The rationale for focusing on literature study instead of conducting empirical investigation is that it demands a lot of time to monitor an SPI project. Further an empirical investigation might be influenced by cultural and organizational effects. In order to complete our effective research; we focuses on case studies reported in SPI literature.

SPI literature is included with case studies reported by practitioners and researchers. We selected only case studies those pursued maturity driven SPI e.g. CMM.

In order to collect data we used focus group as our main approach (see figure 3). Focus group is the approach for data collection by discussing in a group. The approach can help to explore and elaborate a subject of interest [9]. We conducted 10 focus groups . First five focus groups sessions were conducted to discuss case studies. For these sessions participants were asked to read through a case study prior to discussion session. The discussion was lead by some open-ended questions. Moreover, three more focus group sessions were conducted to comparatively analyze data collected in previous data collection sessions to ultimately come up with strengths and weaknesses of maturity driven process improvement.

4. Discussion

The present study is aimed to investigate the strength and weaknesses of maturity driven process improvement effort based on focus group discussion. The following section summaries the results about company scenarios along

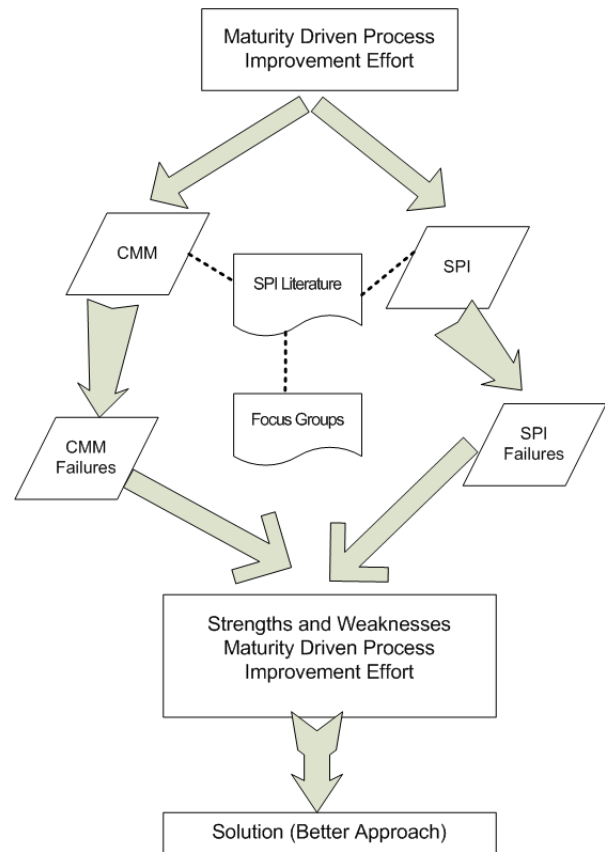


Figure 3. Shows a graphical representation of the research methodology

with brief introduction including strength and weaknesses of each case study determined by focus group.

In following lines strengths and weaknesses of SPI effort of each case study are discussed. What had a positive impact on SPI effort and what could be improved?

Case Study 1

A company ABC (not actual name of the company) is a dollar 2.3 billion publicly held service organization with approximately 12,000 employees located in the U.S. It decided to go for software process improvement and chosen CMM for guidance. The company performed a CMM self-assessment that placed it at level-1. An SPI team was formed which was further divided into the workgroups, each key process area was assigned to one work group. It was estimated to achieve Level-2 within 10 months from the date of initiation of SPI project. But soon it was realized that key practices have not been followed in some areas. After one year another self-assessment was conducted. The results showed that still company is at level-1. After these

discouraging results, it was decided to hire consultant to guide process improvement. Again every thing was started from beginning. After one year again assessment was made and it came to know that company has achieved the Level-2. The company achieved its goal after two years than its original deadline [10].

Strengths

- Management showed perseverance and commitment despite failure in the SPI project.
- Allocation of resources that is staffing and funding.

Weaknesses

- Company has set wrong motivation that is hanging banners and proclaiming achievement of Level-2, instead of sincerely looking for process improvement.
- Company has no professional resources to lead the process improvement effort to success.
- Optimistic time estimation.
- There was lack of commitment in some workgroups.

Case Study 2

DataStream was established in late 1990's and after few years expanding business needs made things complex and difficult to handle. In order to overcome problems; it was decided to implement CMM. In the initial preparatory stage to implement CMM, three areas were identified to that the company needs to resolve to help themselves grow. The target was to achieve Level-3 in one year. In the startup; strategy was developed. Moreover, four goals were identified and ten areas were chosen from CMM that may help to achieve these goals. While achieving CMM was the main driving force behind these activities but focus was to improve the practices that would promote the success of company. After working for 18 months in the company, CMM level-3 was not achieved but it was very closer to achievement [11].

Strengths

- Management showed perseverance and commitment despite failure in the SPI project.
- Formal reviews to keep management interest alive.
- Process improvement goals aligned with organizational needs.

Weaknesses

- Responsibilities were not properly assigned.

- Lacking SPI personnel commitment.
- In-experienced staff.

Case Study 3

AB Alna is a leading IT company of Lithuania. Company started the software process improvement project in 2001. IDEAL methodology was chosen to run process improvement project. The first goal was to achieve CMM level-2. Process improvement was conducted evolutionally, where steps were defined. Evolutionary approach took too much time but it involved maximum people in process improvement. SPI project was divided in different phases and resources were also assigned accordingly. Three years of effort resulted in attainment on CMM level-2 in 2004 [12].

Strengths

- Realistic estimates.
- Acknowledging the importance of management commitment.
- Establish open communication.

Weaknesses

- Lack of planning.
- SPI personnel commitment.

Case Study 4

The software process improvement project was conducted in one unit of Nokia that is Fixed Switching Research and Development. Software Process Improvement journey was started in 1995 by implementing ISO 9000 practices. The improvement practices continued in subsequent years by initiating process metrics, testing process, and then CMM practices were established [13].

Strengths

- SPI teaming: try to involve all stakeholders up to some extent.
- Measurements.
- Taking process improvement effort as a project.

Weaknesses

- The focus was to get aligned with process models. There was no focus on SPI itself and organizational needs were not explicitly set as process improvement goal.

5. Results

Weaknesses of MDPI Efforts

Not feasible for small organizations : CMM is basically designed for large organizations; it is not perfectly compatible for smaller organizations. The focus is just to achieve a label of specific maturity level. The wrong motivation is only for business gains rather than SPI.

Wrong motive: It demands investment of a lot of unnecessary resources, i.e. time, money, and personnel. You might have to work on process areas having no importance for organization; but a necessity for a maturity level.

Leading to lack of management commitment: When all efforts are merely for achievement of demands of maturity levels; then definitely organizational needs of SPI are overlooked. If return of investment is not visible then top management will no longer be committed with SPI goals.

Need of specialized personnel : The well known problem with maturity driven methodologies like CMM is lack of guidance to drive SPI project. It makes difficult for an organization lacking specialized consultants for SPI; and ultimately process improvement effort might end up on failure.

Introducing bureaucracy in organization: The practices challenge authority of employees and introduce more bureaucracy. Many processes are imposed having no explicit value for employees.

Strengths of MDPI Efforts

Enhanced credibility in business market: The level of any organization's process maturity shows its level of credibility. Any organization at high level of maturity sounds more trustworthy than others. That is one of the reasons that motivate companies to improve their process maturity level.

Proactive preparation for future challenges: Though maturity driven practices don't prescribe how to do; but still clear goals are provided on what to do. It provides an opportunity for an organization to improve processes organizational wide. These processes might not be an immediate need of organization but could prove useful in the long run and might prevent many overcoming problems.

Process synchronization advantage : MDPI efforts are widely known in industry. It helps to win business share. For instance CMM practices are widely adopted in US. Any organization that has established same practices will have

more likelihood to strengthen business ties to other organizations.

Coping distributed business environment challenges : In distributed business environments; it can help to overcome many cultural impediments due to common processes. These methodologies having well established vocabulary will have better impact on communication and will enhance understandability.

Well established practices : MDPI methodologies are developed by many experienced professionals having several years of experience and deep understanding of problems and challenges of domain. Moreover, these are being practiced in industry for several years. Thereby, MDPI efforts can prove useful for organizations seriously thinking about SPI.

6. Conclusion

Last two decades have witnessed a wide proliferation of maturity driven process improvement efforts. But the statistics of software community shows that many process improvement efforts don't end up successfully. The present study investigates the strengths and weaknesses of maturity driven process improvements.

The study shows that MDPI efforts could prove very useful due to following factors: 1) Enhanced credibility in business market. 2) Proactive preparation for future challenges 3) Process synchronization advantages 4) Coping distributed business environment challenges 5) Well established practices. But, on other hand there are some associated risks as well listed as follows: 1) Not feasible for small organizations 2) Wrong motive 3) Leading to lack of management commitment 4) Need of specialized personnel 5) Introducing bureaucracy in organization.

The study suggests that process improvement initiatives should be tailored addressing organizational needs instead of blindly pursuing maturity models prescriptions. Furthermore, it is suggested to have an inception phase prior to an SPI initiative to decide whether a maturity driven process improvement approach should be opted or an effect driven process improvement approach. All decisions should be made by considering organizational needs, but future needs should not be overlooked anyway. The decision could prevent from many possible SPI impediments and certainly enhance the probability of completion of an SPI initiative by improving processes and consequently winning market share ultimately.

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