

Comparative Analysis of Process Models in Software Engineering

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Abstract

Software systems pass through a series of passages that account for their inception, initial development, productive operation, upkeep, and retirement from one generation to another. Software Process Improvement (SPI) is a systematic approach to improve the software development organization's ability to deliver quality software within time and budget constraints. The aim of this paper is to develop a model which would be useful in practice for software development companies. The proposed model is a generic model which is beneficial for a small firm as well as a large firm. This proposed model does not focus only on quality assurance but also the culture of the organization. It describes how this model can be used to guide software organizations in process improvement, and the various assessment and evaluation methods.

Keywords

Software Process-Improvement, Software Process Improvement Model, Requirement Gathering, Process Definition

I. Introduction

A software process improvement method is defined as an integrated collection of procedures, tools, and training for the purpose of increasing product quality or development team productivity, or reducing development time. Software process improvement upgrades an immature organization to a mature organization. An immature organization can not generate a good quality product. There are lots of reasons for failure of a software project. Their work methodologies make no sense, no coordination between the senior management and middle management.

II. Proposed Software Process Improvement Model (SPIM)

Software process improvement model is an approach or method or both by which process improves and give better result rather than a normal process. By software process improvement a better and high quality product can be found within budget and time. This paper suggests a Software process improvement model. This model is an iterative and cyclic model. This model consists of ten steps. These are following:

- Requirement Gathering
- Process Definition
- Problem Definition
- Recommendation and Assessment
- Planning
- Prototype Model
- Implementation
- Evaluation
- Configuration Management
- Documentation

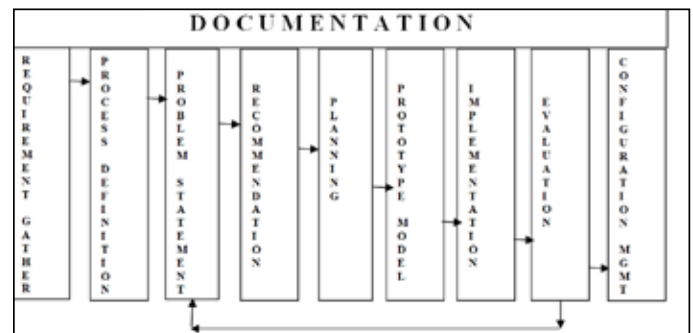


Fig. 1: Software Process Improvement Model

A. Requirement Gathering

Requirement analysis is critical to the success of a software project. All requirements should be clear before developing the project. The requirement should be documented, actionable, measurable, testable, and traceable related to identify software needs and defined to a level of detail sufficient for software process model.

B. Process Definition and Problem Definition

A doctor can give the medicine when he knows about the patient's disease. Without knowing about the disease they cannot do anything. Similarly any process improvement model can work accurately if we know the exact problem in process. Therefore the main issue is to make the problem clear. When problem is clear then a solution can be found. What processes have taken for the development of the project? Then he can find the shortcoming in the process why the process is not giving a better quality or why project can not complete within time that has been promised to the customer. So the first step is to understand the process. A lot of development process models exist. For example if customer want the project to be done as soon as possible. At that time RAD model should be apply. Developer can't apply any other model. A lot of models are available for software process. Waterfall model, spiral model, iterative model etc. We study the process and try to find the shortcomings. These issues may become the cause of unsuccessful project.

- Lack of management
- Lack of well communication
- Lack of well communication between customer and organization
- Technical problem and lack of resources
- Lack of man power
- Not provided a good training
- Ego problem
- Working inadequate way

Table 1: Categories of the Problem

	Cause of problems	Category out of 1 scale
1	Lack of management	.08
2	Lack of well communication	.06
3	Lack of well communication between customer and organization	.06
4	Technical problem and lack of resources	.08
5	Lack of man power	.06
6	Not provided a good training	.05
7	Ego problem	.04
8	Working inadequate way	.04

C. Assessment and Recommendation

Once the problem is defined, one can easily find out the area need to be improved and then according to the problem, an assessment team is formed with recommendation of higher authorities. Team depends upon the management and size of problem. Team, which is so formed, should have highly qualified and experienced members. If the size of the problem is small, a team of 2-3 researchers are good enough. If the improvement area is large enough, then team will be formed according to the size of problem.

D. Planning

After formation of assessment team, they start work on the project. They make plan and prepare strategy about how can they improve process by finding changes required. For this, first of all entire problem should be clear and defined. Team now makes a questionnaire for the members coming from different levels in organization. Analyze the current situation of the company and then make a profile for the future of the company. For that, they conduct interviews of as many people as possible and make a plan. If there is more than one strategy for any process improvement, then they choose one which produces the better result. With the approach defined, a detailed implementation plan can be developed by taking consideration of all the factors like, technical and non technical. When the team completes the plan, they have a meeting with the senior management and there they give a presentation to the seniors. By doing this they reduce the risk level significantly.

E. Prototype Model

Before implementing the software process model, a prototype model should be shown to the end user. After the confirmation by the end user, software process improvement model will be implemented.

F. Implementation

When the plan is established according to the problem, then perform the implementation. First make a paper solution on basis of experience and knowledge as well as skill of the assessment team. Then again gives presentation to the higher authorities. If they give some suggestion for modification in the solution, then modify the plan accordingly and if they are comfortable with the solution then start the implementation. Before implementing the plan it should be discussed with the senior management and

organization. When they are agree on solution, start working on the solution. Whole solution should not be applied in one step; it is a step by step process. Makes a baseline after every step and take a pilot test and check the result if the result is positive then next continue the solution. If there are more than one solution, in this situation don't take decision without consultation. Again discuss with the higher authorities. Which solution seems better then apply the solution. By doing this risk is less because at this situation team is not responsible and if the plan is successful then all the credit goes to the assessment team.

F. Evaluation and Configuration Management

An inspection is generally an organized examination or a formal evaluation exercise. It involves the measurements, tests, and gauges applied to certain characteristics in regard to an object or activity. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets. Inspections are usually non-destructive. It is not guarantee that the work plan and implementation is correct. For inspection a team is formed, in which members are moderator, reader, and inspectors. A formal meeting is conducted. Role of the moderator is to conduct the meeting and ensure the subject of the meeting. Role of the moderator is like a leader of the inspection team. So moderator should be highly qualified and skilful. Moderator tells the team how the inspection starts and leads them. Evaluation team takes the interview of assessment team. They make a questionnaire for every member of team. Review of the work done by all and they analyse the result. What result will come after process improvement? Review all the factors came in the technique. Main motive of the evaluation is to find the defect in the module.

G. Documentation

Documentation is an umbrella activity in this model, which is going on side by side throughout process. In each phase documentation is needed. Documentation is needed for the future work so that anybody can reuse it as well as future work can be done. The documents associated with a software project and the system being developed has a number of associated requirements. They should act as a communication medium between members of the development team. They should be a system information repository to be used by maintenance engineers. They should provide information for management to help them plan, budget and schedule the software development process. This model is a cyclic model. After configuration, it will go for problem assessment and same procedure will be done again till the process improves and gives a better output rather then the normal process.

III. Comparison Between CMM, SPIM and Ideal Models

In this section, we compare propose software process model with other models. Its work methodology is different with other models [4, 6, 9, 13].

S.NO.	CMM	SPIM	IDEAL MODEL
1	It is a methodology used to develop and refine an organization's software development process. The model describes a five-level evolutionary path of increasingly organized and systematically more mature processes.	It is an approach or method by which process improves and gives better result rather than normal process. In SPIM model implementation is defined and a proper document is prepared for every process.	The IDEAL model has been defined as a life cycle approach for process improvement model. It was developed by the Software Engineering Institute (SEI) and is based on the Capability Maturity Model (CMM).
2	CMM works on software.	SPIM model works on software and organization both.	It is an organization improvement model That serves as a roadmap for initiating, planning and implementing improvement actions.
3	CMM is a goal. Being used just as a stamp of approval.	SPIM model is a method. It works as a full flash model.	Ideal model is also a continuous model. But it is a full method such that there is no recovery. Means either it is success or fail.
4	The main limitation of CMM is the key- practice describes "what to do" but does not prescribe "how to do".	SPIM model describe the implementation and prescribe how to do.	Ideal model is also a continuous model. But it is a full method such that there is no recovery. Means either it is success or fail.
5	CMM is works only a repeating task.	The SPIM Model does not necessary to work for the repeatable task. When the new problems come it will work for that also.	IDEAL Model is a full method such that there is no recovery.
6	Although the CMM model gives the maturity level but does not specify the implementation.	SPIM Model is a flexible model. If, There is any change in the process; SPIM covers all the aspect of the changing of process due to cyclic model.	IDEAL model is not flexible as comparison to other models.
7	The goal of CMM model is to help organization to improve their performance.	The objective of SPIM Model is improving the quality of software product ability to work with in time and budget constraints. Remove the limitation of previous models like that in CMM Model.	The objective of IDEAL model is to guide development of a long range, integrated plan for initiating and managing a software process improvement model.
8	It is not a cyclic model. Therefore there is no any chance of recovery.	SPIM model is a cyclic model. So if any problem face then it will work until improvement has not completed.	It is not a cyclic model.

IV. Conclusion

The proposed Software Process Improvement Model (SPIM) improves the process in a traditional way. This model is an iterative model. The SPIM model does the process improvement in a stepwise way. It covers user requirements, software quality assurance, and organization point of view. Many of the factors can be found in the organization using SPIM model like management commitment and teamwork. SPIM model covers the some limitation of existing model (CMM, SIX SIGMA, and IDEAL). For example, the main limitation of CMM is the key practice that prescribes "what to do" but does not prescribe "how to do". SPIM model describes the implementation and prescribes how to do. The SPIM Model is not necessary to work for the repeatable tasks. When the new problem comes it will work for that too. SPIM is a flexible model. If there is a change in the process, SPIM covers all the aspect of the changing of process due to cyclic model.



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