



An Empirical Study of Impact of Software Development Model on Software Delivery

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Abstract: Software engineering is the science which lay down the matrices to control poor quality of software and specify the practices to deliver software on time and within budget. Software development model to be used for the development of the software is a major issue of concern for the software developer. There are many software development models laid down in software engineering like Waterfall, Iteration, Spiral, V-Shaped etc. Each has their own merits and demerits. The main focus of this study is to find out the best model in use in the software industry which has positive and direct impact on software delivery time. For this purpose a questionnaire was developed which was filled by respondents who have worked on various software development projects in the various companies of Gurgaon, Pune and Ambala.

Keywords: Software Engineering, Software Development Models, Software Development Life Cycle

I. Introduction

Software Engineering, the youngest field of engineering is the science which controls design, testing and maintenance of software development. Its main objective is to define the rules, matrices and models to deliver quality software on time and within the budget. In Software engineering, various software development models have been developed for the development of the software depending on the aims and objectives of the software. These models specify the various stages of the process and the order in which they are carried out. These models are as follows:

1. Water Fall Model
2. V Model
3. Incremental Model
4. RAD Model
5. Agile Model
6. Iterative Model
7. Spiral Model.

Each model has its own merits and demerits. This study focuses on two models waterfall and Spiral. The aim of this study is to analyze these models and find out which model has maximum success rate as far as the on time delivery of the software is concerned. For this purpose a survey was conducted in various companies in India and studied 22 different projects and analyzed the impact of model used on software delivery time.

A. System Development Life Cycle:

In Software engineering, System development life cycle is defined which defines the different stages which has to be used by software engineers to design software effectively and efficiently. The main objective of SDLC is to develop high quality software with in the scheduled time frame and budget and fulfill the customer needs.[1] To manage the complexity of Software development, SDLC models have been developed which are as follows

A.1. Water Fall Model: Water Fall Model is the oldest model and is also known as linear-sequential life cycle model. It is the simplest model in which every new stage starts only after the full completion of previous stage. This model emphasizes This model is basically used for small scale projects and there are well defined requirements of the customer. Each stage is followed with a feedback to review that project is going in the right direction or not. In this model testing is done only after the development is over.

1. Requirement Gathering and analysis: The very first step in this model is collecting the requirements from the customer and defining it in clear and precise way. After the requirements are laid down then the analysis of the requirements is done which includes understanding the customer's problem area and final output required by customer and functions to be performed by the software using the techniques of interviews, group discussions, on site observation or use cases. The results of the analysis are documented in a formal document known as System Requirement Specification which is used by the design phase for the further designing of the software.

2. **System Design:** Based on the requirement analysis, in the design phase interfaces, modules, data tables, validations, hardware and software platform to be used , language for the development to be used is defined.

The stages of “Waterfall Model” Are graphically depicted below:

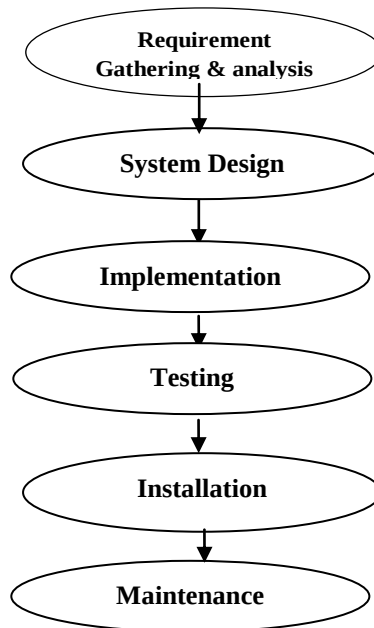


Figure: 1

3. **Implementation:** On the basis of the specification laid down in the design phase, product is actually designed in this phase. This phase is performed by the team of software developers. This phase involve writing and debugging of code.

4. **Testing:** In this phase , the testing of individual as well as integrated modules is done to verify the error free execution of the code and to tally the output generated with the output required by the customer and laid down in the first phase.

5. **Installation:** This stage includes final installation of the software at the customer site once it is approved and certified by the testers.

6. **Maintenance:** This stage involves making alterations in the software after the installations either to remove the defects encountered during the live use of software or to make the changes desired by the customer.

Merits of Waterfall Model

1. It is the simplest model and easy to be implemented
2. Each stage has well defined start and end point which makes it disciplined and well managed.
3. Each stage is well documented and planned.
4. As it is the oldest method so is widely used and known.
5. Suitable for the projects which are stable and have unchanging requirements.

Demerits of Waterfall Model

1. It is unrealistic as it is not practically possible to complete one stage completely before moving to next stage.
2. Practically customer's requirements keep on changing which require changes in the phases which are already completed..
3. It is Inflexible.
4. Not suitable for long and ongoing projects.

B. Spiral Model:

The spiral model emphasizes on risk analysis. The four stages of spiral model are

1. Identification
2. Design Risk Analysis
3. Engineering
4. Evaluation.

All stages are performed repeatedly in iterations called Spirals throughout the development of software. This model integrates the scheme of iterative development with the methodical, organized and controlled aspects of the waterfall model.

- **Identification:** In this stage requirements are gathered from the customer in the baseline spiral. In the succeeding spirals as the designing of the software matures, further requirements of the system and subsystem are performed in this stage.

The system analyst keeps on communicating with the customer to understand the requirements and to cater to the changing requirements of the customer. The stage is completed with the installation of the product at the customer site.

- **Design:** In this stage logical, conceptual and physical designing of the product is done.

- **Construct or Build:** In this stage actual production of the software is done in each spiral. Customer feedback is taken after designing of proof of concept in the baseline spiral when the product is just thought of and the design is being developed. Then in the succeeding spirals when the requirements are more clear and specific then working model of the software called build is produced with a version number. These builds are sent to customer for feedback.

- **Evaluation and Risk Analysis:** In this stage technical and economical feasibility is analysed and managerial risks such as schedule slippage and cost overrun are evaluated. At the end of the first iteration, the build is tested and evaluation of the product is done by customer and then feedback is taken.

Merits of Spiral Model

- The main advantage of spiral model is that it cater to the changing requirements of the customer.
- Risks are minimized as enough time is given to risk analysis.
- Suitable for large and complex projects.
- As feedback is taken from the customer after designing the build, it assures Strong approval.
- More flexible as additional modules can be added at a later time.

De-Merits of Spiral model:

- It is an expensive model.
- High expertise is required for the task of Risk analysis.
- Risk analysis is a critical stage and the success of project entirely depends upon the output of risk analysis stage.
- Not suitable for smaller projects.

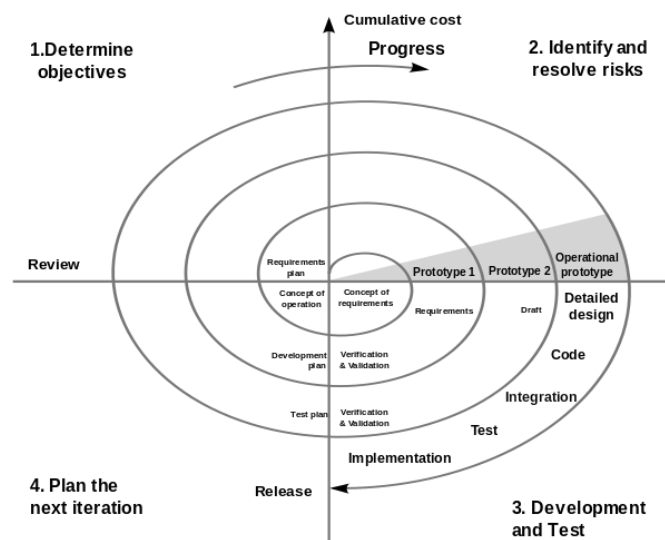


Fig: 2 Spiral Model (Bohem 1988)[3]

II. Objectives of the Study:

Theories say that software can be delivered on time if software developer follows Data models. The objective of this study is to explore the impact of these data models on the software delivery time. In today's competitive world success of any business depends upon the satisfaction of the customer and the scheduled delivery of the software plays an important role in increasing the level of customer satisfaction. Knowing the data models which have more success rate as far as delivery of software are concerned can be a great help to software development teams in the software industry.

III. Research Methodologies

The aim of this study is to identify the impact of waterfall and spiral model on the delivery time of the software. In this study a survey was conducted on some of Indian Companies and tried to put light on the role of spiral and waterfall model in delivering the software on scheduled time.

To prepare the evidence to check the impact of these models on software delivery time, a Questionnaire is prepared and is filled by the authorized employees of the companies from Gurgaon, Pune and Ambala.

Many closed-ended questions were used to minimize the length of the questionnaire, however participants were offered an "Other-please specify" option to prevent forced answers from occurring.

After collecting the data from these companies, analysis of the data is done using frequency tables and graphs tools of SPSS Software.

The sample size used in this study involved 22 software development projects from the companies of Pune, Gurgaon, and Ambala. Due to this reduced sample size, the use of qualitative research methods was preferred.

IV. Questionnaire Results & Analysis

In this study completed questionnaires were received from number of respondents, reporting on 22 distinct projects. The majority of our respondents were developers or project managers from Pune, Gurgaon, and Ambala based companies. The responses to set of 22 questionnaires described 22 projects, 17 regarded as successful as all delivered on time and 07 unsuccessful as were not delivered on scheduled time. The Survey questionnaire had mixed type of questions.

Question was asked which model has been selected by the software development team for the development of software and Software was delivered on time or not.

Water Fall Life Cycle Model is selected 17 times out of 22 projects and 13 times project was delivered on time. Success rate is 76.4%. Evolutionary, Iterative method has success rate as 40%. Spiral and other was not selected by any project.

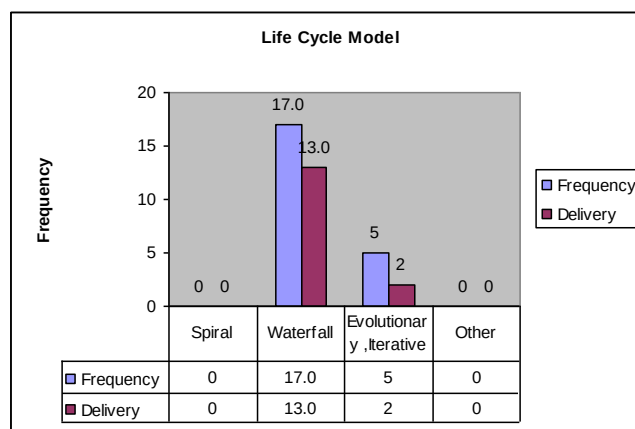


Fig: 3

V. Conclusion

From this survey it is clear that water fall model has more success rate than the spiral model as far as delivery time is concerned.

VI. References

- [1] Systems Development Life Cycle from FOLDOC retrieved 2013-06-14
- [2] CTG.MFA -003, "A Survey of System Development Process Models", Models for Action Project: Developing Practical Approaches to Electronic Records Management and Preservation, Center for Technology in Government University at Albany/Sunny, 1998.
- [3] Boehm B, "A Spiral Model of Software Development and Enhancement", ACM SIGSOFT Software Engineering Notes, ACM, 11(4):14-24, August 1986.