

A Comparative Study of Software Development Waterfall, Spiral and Agile Methodology

Dr. Manohar K. Kodmelwar ¹, Dr. Pravin R. Futane ², Prof. Shilpa D. Pawar ³,
Prof. Sharayu A. Lokhande ⁴, Prof. Sudhir P. Dhanure ⁵

¹ *Asst. Professor, Vishwakarma Institute of Information Technology,
Department of Information Technology, SPPU, Maharashtra, India.*

² *Professor, Vishwakarma Institute of Information Technology,
Department of Information Technology, SPPU, Maharashtra, India.*

^{3,4} *Asst. Professor, Army Institute of Technology,
Department of Electronics and Telecommunication, SPPU, Maharashtra, India.*

⁵ *Asst. Professor, Smt. Kashibai Navale College of Engineering,
Department of Electronics and Telecommunication, SPPU, Maharashtra, India.*

Email: ¹ manohar.kodmelwar@viit.ac.in, ² pravin.futane@viit.ac.in,

³ spawar@aitpune.edu.in, ⁴ slokhande@aitpune.edu.in, ⁵ ind.sudhir@gmail.com

Abstract

Software development methodologies are used for developing the simple to complex project. It gives the idea of how systematically projects are developed. It plays important role in software development in academics to industries. It helps to reduce the chances of project failure. The major development technics like waterfall, spiral and agile methodologies, their processes and comparisons shows that, how efficient development occur. The article used to present the study of these three software development methodologies. The main contribution to this work in study and comparing the methodologies. This study helps the software development in academics and industries to understand and comparison to choose the method according to the application.

Index Terms— Waterfall, Spiral, Agile and Scrum.

I. INTRODUCTION

The software development methodologies play a very important role in developing the project. Any small to complex software development require systematic flow from requirement to maintenance. It helps the group to develop the project in collaboration. There are many development methodologies, every method having pros and cons. some are traditional development and rest are evolutionary type. Every development technique is useful, but choosing the best technique is important considering the application. The selection is very important in terms of systematic development. If the application is very small and to be developed in weeks then the proper

methodology is required, otherwise it will make a negative impact on development process, time and deadline skip. The unplanned or without the use of standard methodologies will make major chances of project failure. It can be observed in terms of satisfaction of customers. The chances that, customer may argue at the time of delivery of project about the quality and scope deviation. To avoid this, choosing of right methodologies will increase the chances of customer satisfaction.

II. DIFFERENT SOFTWARE DEVELOPMENT TECHNIQUES

2.1 Waterfall Model

It was used for decades by the industries and academics. It is still used for small applications where the large changes are not expected. It is simple and follows the sequential development. The next stage will start only when the previous stage is complete. The stages are dependent on the completion of earlier stages. It follows the approach of requirement, design, development and maintenance.

Paper proposes many efforts in this regard lead to various proposals of smooth integration of SE (software engineering) processes with HCI (human computer integration) for product development [10]. This paper discusses two main software engineering methodologies to system development, the waterfall model and the object oriented approach, appropriateness of each approach in relation to the complexity of the problem domain [16].

2.2 Spiral Model

It handles the risk in development phases. In spiral the number of loop depends upon the project. In the first quadrant the requirements are collected from the customer and possible solutions are found. In the second quadrant the risks associated with solution found and resolved. In the third quadrant the solution is developed and tested. In fourth quadrant developed version is checked by customer and planning for the next iteration will start.

Spiral model and its application are used in various scenarios such as website development, mobile application development and traffic management system [1]. The objective of this paper is making a comparison between spiral process and scrum methodologies to show their features and defects. Also examine the circumstances of using either spiral process model or scrum methodology while developing software project [11]. In this paper we are going to take different models for the development of mobile applications cannot be included in the basic phases of SDLC but also focusing on the

other factors including cross platform development, memory usage, way of interaction with user and the model is proposed for the Mobile Application Development Life Cycle [12].

2.3 Agile Methodology

It is an iterative development. It divides the task into smaller tasks. Each iteration takes one to four weeks. Each phase includes the requirement, design, implementation testing and feedback. This model is used for quick development. Agile model basically to accept the any changes at any stage and implemented in the next iteration. The expected output is delivered at each iteration in incremental way.

The proposed method includes the best practices from change management, methodology adaptation [8]. Paper includes different approaches of agile. Agile software development; Extreme Programming; Scrum; Feature Driven Development; limitation; agile manifesto[5]. Paper describes to identify various challenging factors that restrict Agile and User Centred Design Integration (AUCDI) and explore the proposed practices to deal with them [13]. Agile process is an iterative approach in which customer satisfaction is at highest priority as the customer has direct involvement in evaluating the software [9]. Academics projects are facing the problem of controlling and monitoring small projects and there is need to improve the project development in academics. On the basis of a case study using SCRUM method presented [18].

Research direction aimed at formalizing a software development methodology dedicated to innovation orientated IT projects is enunciated.[14]. How to choose the appropriate software development methodology. All the essential points and details about the software development methodologies are reviewed in this paper as well as the advantages and disadvantages of each model [2]. This study finds the widely accepted (JCM) Job Characteristic Model for job design relevant in providing a theoretical foundation for the a

theoretical domain of SDMs [19]. Current programming advancement strategies are displayed. Improvement stages are characterized for each displayed philosophy. The experienced team and project, manager together gives a best methodology [6]. In this paper focusing on two popular development processes, Rational Unified Process (RUP) and Agile Process, with their several methodologies and implementation and uses sociometric and motivation research methods [15]. The basic motive of this paper is to enact the variety of models and make a relative study of them to show the attributes & shortcomings of each model [3]. Choosing an appropriate management structure can make a big difference in achieving a successful end result when measured in terms of cost, meeting deadlines, client happiness, robustness of software, or minimizing expenditures on failed projects [17]. Analyze the model & some of the improved software development models and their applications according to certain application fields are introduced briefly [4]. This study proposes a model for the spiral development process with the use of a simulator (Symphony.NET), which helps the project manager in determining how to increase the productivity of a software firm with the use of minimum resources (expert team members)[7]. By studying these software development methodologies, the methods to use according to the application development. As per the customer requirement and his satisfaction the agile method will be better, but the increase in workload may decrease the efficiency of developing team. New approaches to satisfy all stakeholder should be developed which can give better documentation and conducive environment for development. The more focus on quality, finite estimation of project time and cost is required. Some changes are required in existing development methodologies.

III. COMPARISON

S. No	Points	Waterfall	Spiral	Agile
1	Method	Sequential method.	Evolutionary method.	incremental & Iterative
2	Customer	Easy to understand	Tough to understand	Easy
3	used for Type of project	Small	Large	Large
4	Risk identification	Later stage	Earlier stage	Every stage
5	Flexibility	Difficult to adopt changes	Easy to change requirement	Changes accepted at any stage
6	RISK OF USE	Higher	Lower	LOWER
7	SIMPLICITY	Simple	Complex	EASY
8	CUSTOMER INVOLVEMENT	Less	less	MORE
9	DEADLINES	Large	large	SHORT
10	CLARITY IN REQUIREMENT	Beginning	Beginning	REQUIREMENT DYNAMIC
11	COST	Fixed	May change with process	FLEXIBLE
12	TASK	Phases	Iterations	SPRINTS
13	FOCUS	Project delivery	Project delivery	CUSTOMER SATISFACTION
14	TESTING	After development stage	IN EACH ITERATION	IN EACH ITERATION
15	DEPENDENCY	Project manager	Project manager	SCRUM MASTER
16	TEAM SIZE	Large	Medium	SMALL
17	DOCUMENTATION	More	More	LESS

IV. CONCLUSION

The paper describes different software development methodologies. The waterfall method is suitable for small projects and states the use in human computer interface with complex problem domain. Spiral model reduces the risk and states the use in web and mobile application domain efficiently. Agile model for faster development will be used. it also find useful in change management, customer satisfaction and used for academic project development. As per study of these three software development methodologies, the use will find according the selection & complexity of project, to increase successful software development in different domains and sectors. With the change in frequent needs of customer, we can consider the agile model can be better to handle.

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REFERENCES

1. Dhruv Doshi, Labdhi Jain, Kunj Gala "REVIEW OF THE SPIRAL MODEL AND ITS APPLICATIONS" International Journal of Engineering Applied Sciences and Technology, 2021 Vol. 5, Issue 12, ISSN No. 2455-2143, Pages 311-316
2. Ms. I.G.U.Dilmini Rathnayaka, Dr. BTGS Kumara, "A Review of Software Development Methodologies in Software Engineering" IJARIE-ISSN Vol-6 Issue-4 2020
3. Mani , Yogesh Kumar, "A REVIEW PAPER ON SOFTWARE DEVELOPMENT LIFECYCLE MODELS" JETIR Volume 5, Issue 2, February 2018,
4. Jiujiu Yu "Research Process on Software Development Model", ACMME 2018.
5. Riya Shah, "A Literature Review on Agile Model Methodology in software Development" IJARIE, Vol-3 Issue-6 2017.
6. SARANYA P, MONICA V, PRIYADHARSHINI J, ASST. PROF. DEEPA N, "COMPARATIVE STUDY OF SOFTWARE DEVELOPMENT METHODOLOGIES" irjet Volume: 04 Issue: 05 | May -2017
7. Abdullahi Yusuf Egwoh ,Ogwueleka Francisca Nonyelum, "A SOFTWARE SYSTEM DEVELOPMENT LIFE CYCLE MODEL FOR IMPROVED STUDENTS' COMMUNICATION AND COLLABORATION" IJCSES, Vol.8, No.4, August 2017
8. Arturs Rasnacis, Solvita Berzisa, "Method for Adaptation and Implementation of Agile Project Management Methodology" Science direct, Elsevier ICTE, December 2016
9. Anupama Kaushik , "A Literature Review on Agile Software Development" IJARCCCE. ,Vol. 5, Issue 9, September 2016.
10. Rajesh H. Kulkarni, P.Padmanabham, K.K.Baseer "Critical Review of Extended Waterfall Model" IJSER, Volume 6, Issue 11, November-2015
11. Akanksha Mathur , Archana Acharya "A Comparative Study on Utilization of Scrum and Spiral Software Development Methodologies: A Review" IJERTV4IS110154 Vol. 4 Issue 11, November-2015.
12. Akansha Khandelwal, Garima Tyagi, "Review Paper on Suitability of Traditional Prototype Model and Spiral Model used for Mobile Application Development Life Cycle" IJERT, 2015.
13. Dina Salah, Richard F. Paige, Paul Cairns "A Systematic Literature Review for Agile Development Processes and User Centred Design Integration" May 2014.
14. Mihai Liviu DESPA "Comparative study on software development methodologies" Database Systems Journal vol. V, no. 3/2014
15. Neetu Kumari Lodhi , Prof. Pankaj Dalal , "Software Development Process and Methodologies: A Review" IJERT, Vol. 3 Issue 11, November-2014
16. Adetokunbo A.A. Adenowo, Basirat A. Adenowo "Software Engineering Methodologies: A Review of the Waterfall Model and Object Oriented Approach" IJSER, Volume 4, Issue 7, July-2013.
17. David C. Young, "Software Development Methodologies" ResearchGate, 2013
18. Sonali Pathak, Pushpendra Pateriya , Preet Pal "A Case Study on Software Development Projects in Academic Knowledge Centers using SCRUM" International Journal of Computer Applications Volume 43– No.10, April 2012
19. Adarsh Kumar Kakar, "A THEORY OF SOFTWARE DEVELOPMENT METHODOLOGIES" SAI, 2012

AUTHORS

- Dr. Manohar K. Kodmelwar, PhD, Vishwakarma Institute of Information Technology, manohar.kodmelwar@viit.ac.in
- Dr. Pravin R. Futane, PhD, Vishwakarma Institute of Information Technology, pravin.futane@viit.ac.in
- Prof. Shilpa D. Pawar, ME , Army Institute of Technology, spawar@aitpune.edu.in
- Prof. Sharayu A. Lokhande, ME, Army Institute of Technology, slokhande@aitpune.edu.in
- Prof. Sudhir P. Dhanure, ME , Smt. Kashibai Navale College of Engineering, ind.sudhir@gmail.com