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Selection of Software Development Methodology (SDM): A Comparative Approach

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Abstract: Software Development Methodology (SDM) maps the different activities performed on a software product from its inception to retirement. There are different methodologies used to develop the software product s.t. waterfall, prototype, spiral, iterative, RAD, XP etc. Since there are many methodologies, one of the challenges faced by software developer is to decide which methodology to apply in a software project. Selecting a methodology depends on project features or characteristics and no one methodology is ideal or always the best. In this paper we present a comparative approach among different software development methodology to select an appropriate methodology for a specific project.

***Keywords*: Software Development Methodology (SDM), RAD (Rapid Application Development), XP (Extreme Programming).**

I. INTRODUCTION

A software development methodology (SDM) is a formalized approach for the development of software. Although there are many different SDMs, their fundamental systems development life cycle (SDLC) activities are common [3]. These activities or 'phases' are briefly described below:

Planning: It is the fundamental process of understanding why a software system should be developed and determining how the project team will go about building it.

Analysis: The analysis phase answers the questions of what the system will do (requirements gathering), who will use the system, and where and when it will be used.

Design: The design phase determines how the system will operate (in terms of software, hardware and network infrastructure), the user interface and the specific programs, databases, and files that will be required.

Implementation: During this phase the system is actually built. It includes system construction, testing, installation, and post-implementation support and improvement.

Literature survey revealed many SDMs used in software industry. The major SDMs include: Waterfall, prototype, iterative, spiral, RAD and XP development methodology.

Selection of software development methodologies:

In case of software development project, it is very important to use a methodology that must be cost effective and high success rate. A report of the Standish Group International (2009) on projects success rates shows that 32% of all projects succeeded (delivered on time, on budget, with required features and functions), 44% were challenged (late, over budget and/or with less than the required features and functions) and 24% failed (cancelled prior to completion or delivered and never used). The use of an appropriate methodology plays an important role in developing software, to assure that it is delivered within schedule, within cost and meets user's requirements. There are so many approaches are exist to select a software development methodology. Some of them are as follows:-

- Rule based expert system approach by M. Ayman Al Ahmar, (2010).
- Organizational Characteristics based SDM selection approach by Adrienne Farrell, (2007).
- Big-M approach by Cockburn, A. (2000).
- CUQuP (Complexity, Uncertainty, Quality and Phase) approach by Yusof, M.M., Shukur, Z., Abdullah, A.L. (2011).

The main purpose of our research is to present a comparative approach among different software development methodologies based on project characteristics and select the most appropriate software development methodology for a specific software development project.

II. LITERATURE REVIEW

In our research we review some popular Software Development Methodologies (i.e. waterfall, prototype, iterative, spiral, RAD, XP etc.) as well as some research paper on selection of SDM, which are as follows:

Selecting a software development methodology based on organizational characteristics by Adrienne Farrell (2007): In this thesis author provides an overview of software development methodologies and presents a high level analysis and evaluation of each methodology. She (author) also examines organizational characteristics and structures. Characteristics related to the bureaucratic nature of the organization are explained and analyzed as are organizational structure, product complexity, work effort, work type, change philosophy and management, and organizational size. Given all of these characteristics some basic organizational types are presented including entrepreneurial, innovative, machine, diversified and professional. According to the organizational structure, most appropriate software development methodology for that organization should be chosen.

Influence factor for the choice of a SDM by Cristina Venera et.al. (2011): In this paper author identify and analyze the key factors that influence the decision of choosing the most adequate software development methodology for a specific project. Author analyzes three popular software development methodologies i.e. RUP, XP and RAD and find the relation of the key factors among the model. The findings of the analysis provide information regarding which methodology is best to be used depending on the level of each factor for a specific project.

A Comparison Between Five Models Of Software Engineering by Nabil Mohammed Ali Munassar and A. Govardhan: In this research author focuses on vital and important issue in computer world. It is concerned with the software management processes that examine the area of software development through the development models, which are known as software development methodology. In this paper five different methodologies are taken in to consideration i.e. waterfall, Iteration, V-shaped, spiral and Extreme programming. These methodologies have advantages and disadvantages as well. Therefore, the main objective of this research is to represent different models of software development and make a comparison between them to show the features and defects of each model.

III. PROPOSED WORK

Based on the literature review of different software development methodologies (i.e. waterfall, prototype, iterative, spiral, RAD, XP etc.) and a series of surveys, published by different researchers, exploring the state of practices in this field, we have identified different project characteristics that influence the decision of selecting the most appropriate software development methodology for a specific project are as follows:-

- Based on requirement analysis.
- Based on status of development team.
- Based on user's participation.
- Based on project type and associated risk.

Based on Requirements Analysis:

Requirements analysis	Waterfall	Prototype	Iterative	Spiral	RAD	XP
Are requirements easily understandable and defined?	Yes	No	No	No	Yes	No
Do we change requirements quit often?	No	Yes	No	Yes	No	Yes
Can we define requirements at the starting of iteration?	Yes	No	Yes	No	Yes	No
Requirements are indicating a complex system to be built.	No	Yes	Yes	Yes	No	Yes

Based on Status of Development Team:

Development Team	Waterfall	Prototype	Iterative	Spiral	RAD	XP
Less experience on similar projects	No	Yes	No	Yes	No	No
Less domain knowledge (new to	Yes	No	Yes	Yes	No	No

the technology)						
Less experience on tools to be used	Yes	No	No	Yes	No	No
Availability of training if required	No	No	Yes	No	Yes	Yes

Based on User's Participations:

User's participations	Waterfall	Prototype	Iterative	Spiral	RAD	XP
User participation in all phases	No	Yes	No	No	Yes	Yes
Limited user participation	Yes	No	Yes	Yes	No	No
User have no previous experience of participation in similar projects	No	Yes	Yes	Yes	No	No
Users are experts of problem domain	No	Yes	Yes	No	Yes	Yes

Based on Project Type and Associated Risk:

Project Type and Risk	Waterfall	Prototype	Iterative	Spiral	RAD	XP
Project is the enhancement of the existing system	No	No	Yes	No	Yes	Yes
Funding is suitable for the project	Yes	Yes	No	No	Yes	No
High reliability requirements	No	No	Yes	Yes	No	Yes
Tight project schedule	No	Yes	Yes	Yes	Yes	No
Use of reusable components	No	Yes	No	Yes	Yes	No
Are resources (time, money, people etc) scare	No	Yes	No	Yes	No	No

IV. DISCUSSION

From the above comparative study it is clear that every methodology have some specific characteristics to support a specific project. Suppose a software development project having unclear user requirement then we choose prototype, spiral or XP methodology. Again if the project is highly risky, then we choose spiral methodology to handle technically challenging software products that are prone to several kinds of risks.

If a project having reasonably well-known requirements and time bound project schedule then we choose RAD (Rapid Application Development) methodology for executing the project. Again if a project is simple (having low risk) and small scale (having team size of 2 to 10 people) then XP will be the appropriate methodology.

V. CONCLUSION

Since there are many methodologies, one of the challenges faced by software developers is to decide which methodology to apply in a software project. Selecting a methodology depends on different project characteristics and no one methodology is ideal or always the best. In our research have try some extend to solve this problem by comparing some popular SDM based on project characteristics.

Again the research reveals that if contradiction arises during SDM (Software Development Methodology) selection, then the project characteristics must be prioritized based on organizational culture and project situation [8].

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