

# AGILE-WATERFALL HYBRID MODEL FOR SOFTWARE DEVELOPMENT PROCESSES

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**ABSTRACT:** *System development life cycle models are very significant in developing the software in an organized manner. SDLC provides an active way for developing efficient software. Identifying applicable and appropriate SDLC grants the project managers to control whole development framework of the software product. The key purpose of this study has formed a new software development model that encounters the needs of different systems without any inefficiencies presented in the before models. This research has been presenting a model, Agile-Waterfall Hybrid Development Model which allows the characteristics of the waterfall development model and agile development model. On the basis of a literature review to find out the significance of agile-waterfall hybrid development methods, a survey questionnaire was carried to identify the importance of agile-waterfall hybrid development methodologies. This questionnaire had been sent to 50 software development professionals and gather responses. Statistical analysis has been performed on these responses to identify the results, 70% experts are satisfied with agile-waterfall hybrid development methodologies. Agile waterfall hybrid development methods control project plan with client's prerequisite specification, whereas on the other hand agile-waterfall hybrid methods emphases to achieve advanced encouraging attitude. As a result of this, it overcomes certain software concerns that present in the previous models. Therefore, the new combined model would be an incorporated model, which will be applicable for software programs and systems.*

**KEYWORDS:** Agile and Waterfall Methods, Software Engineering, Hybrid Methodology

## 1.0 INTRODUCTION

An SDLC model allows a dynamic approach for the development of the software product. An SDLC provides an active way for developing efficient software. SDLC has been often a technique where the software can be formulated in an efficient manner. SDLC saves the quality of software and improves the possibility of finishing the software project on the deadline day. SDLC comes with an outline of sequences intended for software development, workforce [1]. Agile methods in software development look to have a higher impact rather than its straightforward effectiveness on success factors [16]. Agile software development (ASD) is the main model in the area of software engineering field which has been broadly implemented by the business and abundant research; publications have accompanied on agile development Practices over the previous decade. The customary way to improve software practices monitors the general engineering pattern of requirements, plan, build, and maintain. These methodologies are referred to as waterfall based mostly taking from the traditional software development pattern. They are also recognized by many further names like plan-driven, documentation driven, heavyweight approaches, and great design up front. Boehm and Phillip described that during in their project development knowledge, requirements often typically modified by twenty-fifth or more. As a result of continuous modifications in the technology and industry backgrounds, it's a challenge for traditional software development methods to form an entire set of necessities up front. Williams and Cockburn also stated that one of the problems of traditional software development methods is the Failure to answer to alteration that often regulates the success or failure of a software product [2]. Standard development strategies are much mature such as five to six years and that they are product development practices based on consecutive structure

software goods and services theory. In customary methods, very many firms and rigid policies, guidelines, processes, techniques, documentations and tools, are mandatory. Conventional methods are all over and they are the only ancient and the correctly tested development approaches to accomplishing the requirements for the majority of the projects and an enormous range of organizations. Conventional methods make easier to detect the possible project risks within the of the development process. Because it explores the project in additional particulars and complexities, and as a result of early alert to the risks makes it easier to plot to stop these known risks. Traditional methods are reflected heavyweight or massive and spiral approaches or waterfall approaches are few common examples of customary methods. The development manner has a very solid influence on the project method, major straight scheduling, and documentation. In Conventional methods, a huge amount of groups is made for more quality oriented work can be achieved [3]. This paper demonstrates the outcomes of 50 interviews that have been directed so as to get input on these agile-waterfall hybrid development methodologies. The results of this experimental study would help organizations in making a conclusion about the significance of agile-waterfall hybrid development methods. With lots of changes in project management practices and technology used to provide effective and successful software projects to the users and business environment, Information Technology leaders want to enhance and adapt to find more effective management approaches therefore agile-waterfall hybrid development methodologies depict to increase the chances of delivering a successful project, and the roles and responsibilities of stakeholders engaged in projects using agile-waterfall hybrid development methodologies.

## 2.0 RESEARCH METHOD

SDLC usually a strategy used in software development which described different levels in the development of the software, beginning with an initial feasibility review to help maintenance with the concluded application. The leading objectives of SDLC have to ensure the shipping and delivery of excellent powerful management controls to increase production [4]. Waterfall model has been the very first and also the most well-known SDLC style. This specific model has been traditionally used inside govt. assignments and in several major corporations. The specific feature of this model can be it is sequential actions. The model has gone downwards through the stages associated with demands user stories, design, coding, screening, and deployment. In addition, it guarantees the look weaknesses before the improvement of a product. This specific model has been useful with regard to projects where high-quality management often a major concern because of its rigorous planning [5]. As a response to traditional waterfall methodology, many agile methodologies have been planned. Agile methodology focused on repetition development methods. It experienced Analysis, Planning, Designing, Building, Testing and Deploy stages. It replicates the life cycle for all the repetitions [6]. It doesn't matter if there are any waterfall models or agile model, each model has individual advantages and disadvantages and organization select models that meet its requirements. Taking this into consideration, it is also concluded that any software development method involved complicated processes which require testing and validation. Hence, it is highly recommended testing and validates solutions before taking it into production and making sure that project requirements are implemented in regards to the specifications. Agile development methods are adaptive instead of predictive. Agile methods embraced modification during different stages of software development because agile methods accomplished changing on client's requirements. Nowadays, business desires and needs changed very quickly, therefore it is important to adjust according to modification instead of sticking to a predefined strategy [7]. The waterfall model assists as a base model for different life cycle models. This model supports the good concept of describe-earlier- design, design-beforehand-code. In agile model, team enriched with further client representatives and managers to offer architectural effort and to performance as coding guides or trainers [8]. To cover up area of belonging to our concern, an online survey was led to agile-waterfall hybrid development methodology. Based on the literature review, a structured survey questionnaire was established. This survey questionnaire covers seven questions associated with agile-waterfall hybrid development methodologies. Feedbacks from the survey questionnaire are defined by rating with semantic scaling method. A significant characteristic of the survey questionnaire was to gather information that will be taken for examination and decision as for our investigation concentration. Consequently, we attracted to point different software houses and various software professionals by an online survey. Keeping in mind the end goal to get the significant response, we invited to professionals who have gained hands on experience on software development processes and methodologies. Additionally, the research

basically goal was to point various IT organizations. 6% of professionals working at CMM level 1 to accomplish agile-waterfall hybrid development methodology. 10% of professionals working at CMM level 2 to outline agile-waterfall hybrid development goals .They examine the project planning and project monitoring and control.12% of professionals working at CMM level 3 to characterize agile-waterfall hybrid development process for projects. 6% of professionals working at CMM level 4 quantitatively managed and controls agile-waterfall hybrid development model. 3% of professionals working at CMM level 5 optimizing agile-waterfall hybrid development models. They focus on agile-waterfall hybrid development model improvement. Remaining 13% of professionals are Master and Ph.D. students. In these survey outcomes population sample size is insufficient to achieve results and proportion of participants in software development strategies are hardly any variances to each other. We are to be expected to examine and accomplish experimental findings on the base of participant's frequency, and essential to explore aims behind experimental conclusions. Then, it will difficult to create a solid assumption about small sample size, but we are worried to simplify, alignment and classify various responses with a specific end goal to donate our exploration findings. We have acknowledged 50 responses from various kinds of software development professionals. Applicants from both software houses and research area were requested through LinkedIn social media network. They comprised Programmer, system analyst, software engineer, software consultants' project manager and Ph.D. students

### 3.0 RESULTS AND ANALYSIS

This section offering the complete analysis of customer communication, client's requirements/demands, quality, risk, development tools, large documentation and customer overall satisfaction of agile-waterfall hybrid development methodology. The first question is:

#### 1. What type of applications, does your organization work on?

We investigated that approximately 54% of professionals with agile-waterfall hybrid development techniques are evolving web-based application. 16% of agile-waterfall hybrid development professionals are developing end user applications. Whereas approx. 12% of professionals/developers with agile-waterfall hybrid development approaches are using desktop applications 6% of professionals with agile-waterfall hybrid development methods are developing distributed application while only 4% professionals are working on multimedia applications. Anyhow 8% of research professionals with agile-waterfall hybrid development approaches are using some other applications.

#### 2. Do you think that agile-waterfall hybrid development method provides you comprehensible communication with your customers/clients?

Results demonstrate that approximately 74% of experts with agile-waterfall hybrid development methodologies are extremely satisfied that their performance with Agile-waterfall hybrid techniques assists them to have good

communication with clients and no one professionals disagree with it. Approx. 26% of the respondent of agile-waterfall hybrid approaches are quite satisfied that observations with agile-waterfall hybrid methods assist them to improved communication with clients.

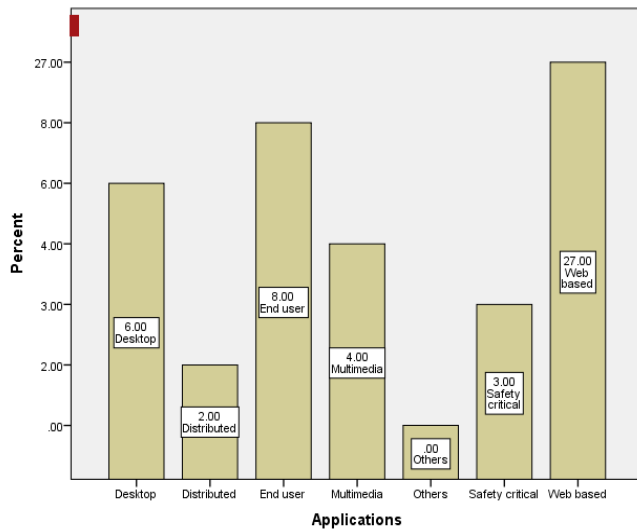


Figure 1: Significance of Application in organization

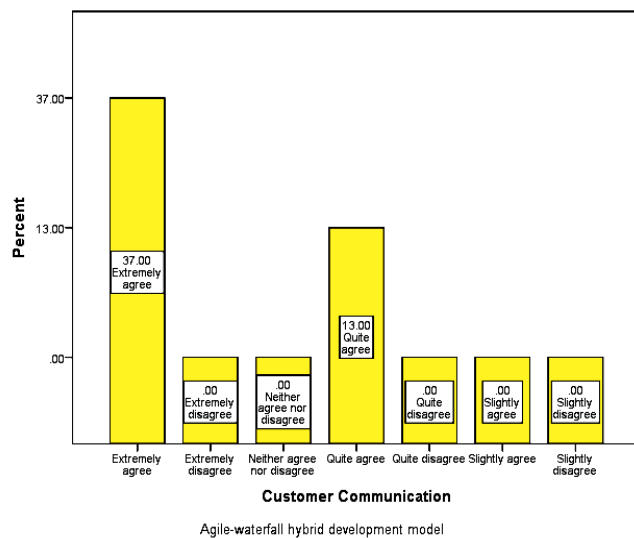


Figure 2: Significance of strategies in improved communication with client

**3. Do you think that agile-waterfall hybrid development method assists you to accomplish your client's requirements?**

Results show that approx. 62% expert employing agile-waterfall hybrid development strategies are extremely satisfied with their performance, keeping in mind the end goal to satisfy client requests/Requirements. On another side, approximately 28% expert using agile-waterfall hybrid development methodologies are quite agreed with methodology regarding achieve client requests/Requirements and approx. 8% of experts are slightly satisfied while 2% expert are neither agreed nor disagreed.

**4. Do you think that agile-waterfall hybrid development method helps you to develop high-quality software?**

A development technique assumes a critical part, keeping in mind the end goal to create high-quality software. The survey results demonstrate that experts utilizing agile-waterfall hybrid software development methodologies are satisfied (extremely satisfied 76%, slightly satisfied 4%, and quite satisfied 14%) with their performance to deliver good quality software. Approximately 4% professionals kept them neutral. Approximately 2% expert is slightly dissatisfied. We can acquire that using agile-waterfall hybrid software development methodology more fulfilled by their technique to deliver better quality software.

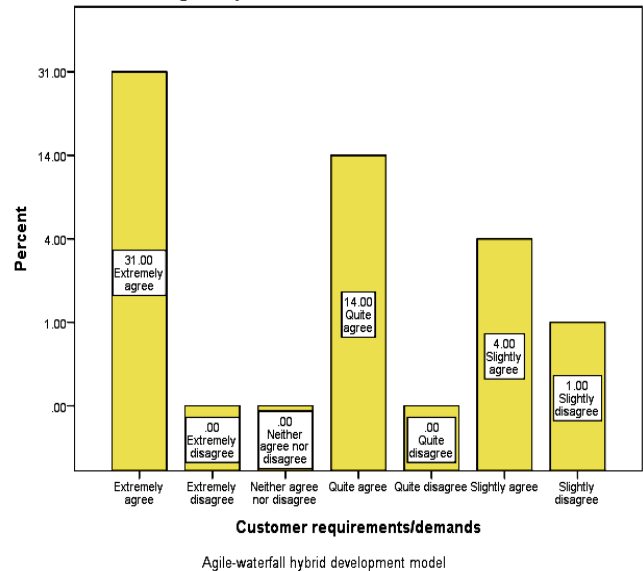


Figure 3: Significance of strategies to accomplish client's requests/prerequisites

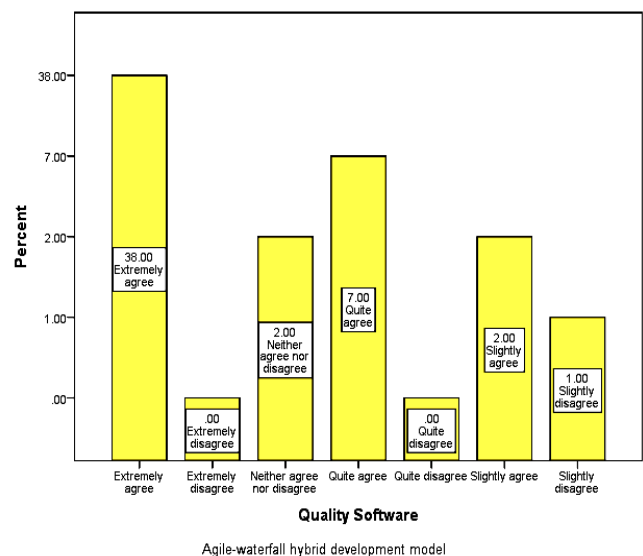
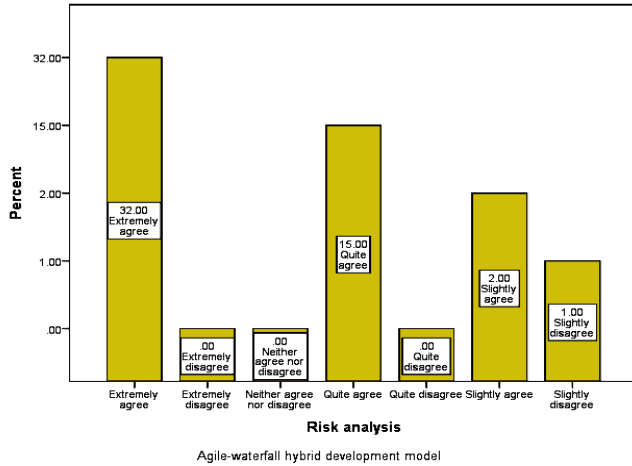


Figure 4: Significance of strategies to deliver high quality software

**5. Do you think that agile-waterfall hybrid development methodologies assist you in risk analysis?**

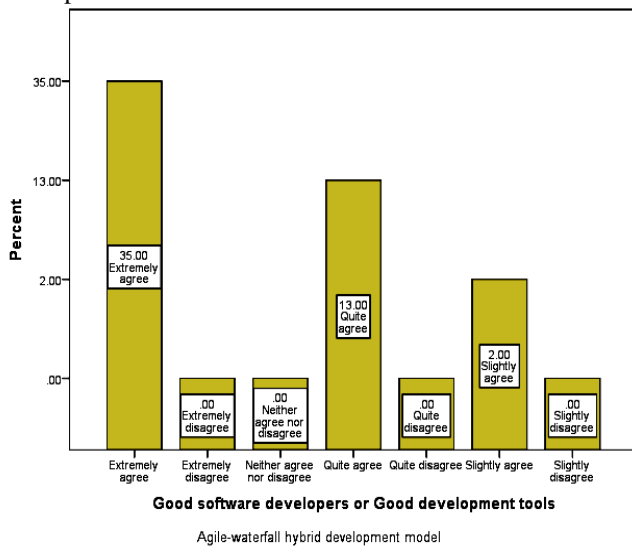
Approximately 64% of using agile-waterfall hybrid development methodologies, customer extremely satisfied in risk investigation, and approximately 4% of agile-waterfall hybrid software development techniques customers responded in slightly satisfied. Whereas approximately 30% agile-waterfall hybrid development methodologies customers are quite satisfied that their method and 2% agile-waterfall hybrid software development methods users are neutral.



**Figure 5: Significance of strategies in risk investigation**

**6. Do you agree that Good software developers or Good development tools in Agile-Waterfall Hybrid project is the vital component when aiming to ensure project success?**

We examined which is exceptionally fascinating, after survey that from experts using the agile-waterfall hybrid development methodologies approximately 70%, experts are extremely satisfied with first one option, i.e. good software developers/designers, whereas approximately 26% are satisfied with the second alternative i.e. good developmenttools/instruments.



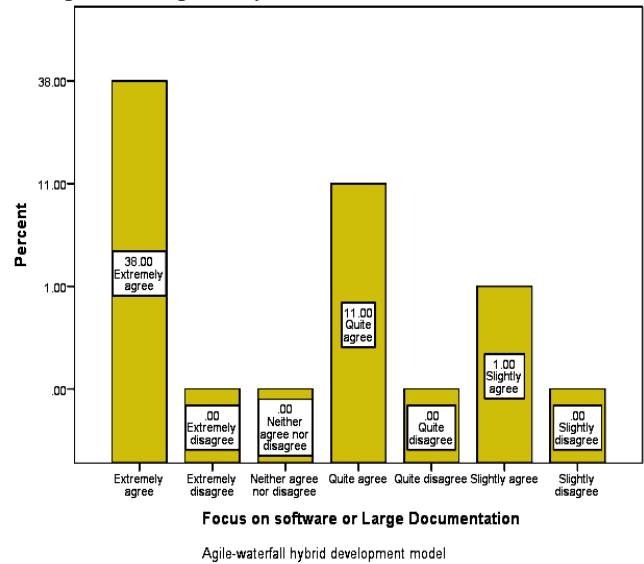
**Figure 6: Good software developers or Good development tools**

**7. Do you agree that Focus on software or Large Documentation in Agile-Waterfall Hybrid project is the vital component when aiming to ensure project success?**

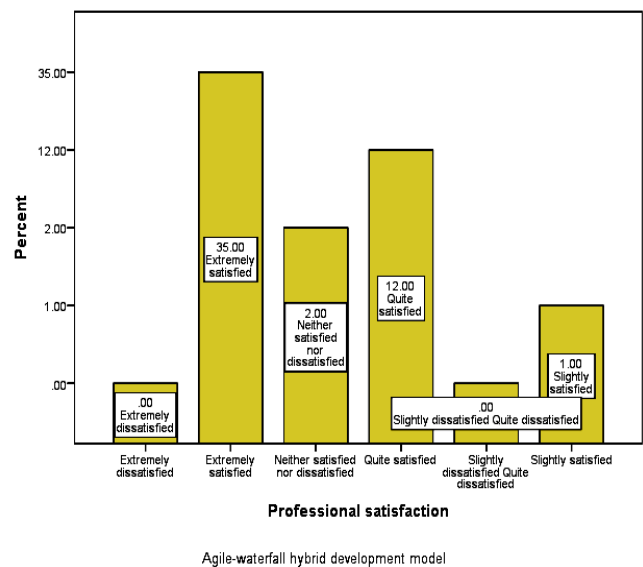
Approximately 76% of experts using agile-waterfall hybrid development methodologies are satisfied on extremely satisfied, i.e. emphasis on software, while approximately 22% agree on quite satisfied i.e. great documentation and approximately 2% are slightly satisfied.

**8. Are you satisfied with your agile-waterfall hybrid development methodology?**

We discover that approx. 70% of total professionals using agile-waterfall hybrid development methodologies are extremely agreed; however, 24% are quite agreed, approx. 19% of professionals/experts are dissatisfied with agile-waterfall hybrid development methodologies, approximately 6% responded impartially.



**Figure 7: Emphasis on Large Documentation**



**Figure 8: Appropriate technique/methods for professionals**

#### 4.0 DISCUSSION

The traditional plan-driven waterfall model is acknowledged, however, it's been criticized for its inflexibility. The actual fact that it's not an incremental model makes it harder to regulate to the software development procedure. The nature of software development needed a lot of dynamic atmosphere that ancient models did not address properly. The agile approach provides a flexible environment, which accepts fluctuating requirements, recovers customer approval by providing sophisticated quality software and decreases the time-to-market related to traditional methodologies [9]. Plan-driven methods, where strength and perfection are usually significant apprehensions, however, these approaches are often measured too hard, uncompromising, and to small degree old-fashioned for numerous software development projects [10]. In 2010, Savaged elevated one methodology that is termed as agile water fall hybrid development methodologies combine. It includes system development life cycle as waterfall model, but at the same moment, every stage is distributed into repetitions [11]. Agile-waterfall hybrid development model simulates the benefits of the earlier different models found in software processes in addition to making comparability between the proposed model and the previous software development models. It also aims to apply the new proposed model to a number of projects to be guaranteed of suitability to show its way of working. Agile-waterfall hybrid development methodologies are preferable in both small and large size organizations, therefore, we summarized as agile-waterfall development methodologies mirror, and it is adaptable for large and small organizations [12]. Agile-waterfall hybrid development experts keen to change quickly in the system due to client requirements. We realize that agile-water hybrid development qualified experts and professional are skilled in their area specialists for non-functional necessities. They have to recognize needs precisely with short system development life cycle [13]. As we described before, agile-waterfall hybrid development methodologies assist in risk investigation where each software development stage wisely studied before going to the next stage [14]. From above mention reasons in our finding, agile methodologies did not support by professionals. Therefore, as said above, the agile method is measured for small level organizations, we claimed that micro organization may not trouble risk investigation. Additionally, they begin approximately coding on preliminary necessities. Therefore, it is recommended that both agile and waterfall can prevent risk together. Agile waterfall hybrid development methodologies help in risk analysis [15]. Keeping in mind the end goal of communication with clients, we promote that agile-waterfall hybrid development methodologies provide comprehensible communication with customers/clients. Regarding this specific, if we recognized the motivation for a client must be a portion of software team by giving effective needs, and initial response to system verification with various test cases. More ever, in small team size as described in developers/designers have felt assured to have well-agreed needs for the instant business importance that support to our result discoveries [11]. In first survey question, we expected to discover the fulfillment/satisfaction level of

experts/professionals on agile-waterfall hybrid development approaches, which may avail them in risk investigation, communication/collaboration with clients and improved quality of software. Overall, as described before, most experts suggested a traditional approach that is more consistent in contrast to agile approaches. We presumed that experts put the concern on reliability than productivity. As described before in our research assists hypothesis where experts are satisfied with traditional practices, therefore, professionals suggest agile-waterfall hybrid development model for both consistency and customer satisfaction. We examined agile-waterfall hybrid methodologies better to accomplish software delivery immediately, according to client needs with high-quality software [9].

#### 5.0 CONCLUSION

We determine that professional/experts are pleased and satisfied with techniques and approaches of agile-waterfall hybrid development methods. For example, with respect to communication with client's agile-waterfall hybrid development methods are thought to be favored. While creating high-quality software and risk investigation agile-waterfall hybrid development methods are viewed as suitable. We find that agile-waterfall hybrid development methods are suitable to fulfill customer needs and requirements. Therefore, hybrid methodologies applied to get the benefits from both agile and traditional methods. According to our research, we find that experts from agile-waterfall hybrid methodology agree with their approaches assist in rapid software development. Experts are gratified with agile-waterfall hybrid development methods and techniques; still, this process should be repetitive and sophisticated with a large number of applicants to the emphasis on all portion of the investigation by distributing it in minor segments. Study conclusion can be applied to different IT organizations' achievement issues for productivity. Moreover, innovative research on the strategies needs, particularly on agile-waterfall hybrid development approaches. Consequently, agile-water hybrid development methodology cooperates for both qualified and inexperienced experts, also it should be refined.

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