Zhivete Model - A Hybrid of V Model and Agile Scrum for Product Development

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Abstract

The New Product Development Process (NPDP) is a systematic approach to product development, consisting of various stages from ideation to commercialization. The Waterfall model and the Iterative (Agile) model are two commonly used approaches to product development, with each having its own strengths and weaknesses. The V-model is a sequential development process used in regulated industries, emphasizing the importance of verification and validation in product development. Although the V-model is well-suited for regulated industries, it can be inflexible and not adaptable to changes in requirements or feedback. Therefore, a more agile model is needed, with continuous testing and validation throughout the development process. In this paper we are Proposing the Zhivete model - a hybrid of V model and Agile Scrum for product development. Offers structured approach with flexibility and adaptation, potentially reducing time and cost.

Keyowrds: New Product Development Process, Waterfall model, V-model, Iterative (Agile) model

1 Introduction

The New Product Development Process (NPDP) is a systematic approach to developing new products and launching them into the market. It typically involves stages such as ideation, feasibility analysis, design and development, testing and validation, and commercialization [1]. The NPDP is designed to ensure that the product is developed efficiently and effectively, with a focus on meeting customer needs, reducing risk, and maximizing return on investment. For engineered products, the NPD process typically includes several stages, including product planning, concept design, detail design, manufacturing, testing, and improvement, and finally, production and commercialization [2]. The specific stages and activities involved in the NPD process can vary depending on the company and the type of product being developed. However, the general idea is to carefully plan and design the product, test and refine it, and finally bring it to market. This process helps to ensure that the product is of high quality, meets customer needs, and can be produced and sold efficiently and effectively.

The Waterfall model and the Iterative (Agile) model are two commonly used approaches to product development [3]. The Waterfall model is a linear, sequential approach where each stage of the process is completed before moving on to the next. This model is suitable for projects with well-defined requirements, where the product development process is well understood and the outcome is predictable. The Iterative (Agile) model, on the other hand, is a more flexible and adaptive approach, where product development is carried out in small, repeated cycles of development, testing, and refinement. This approach is suitable for projects with complex or rapidly changing requirements, where the product development process is not well understood, and the outcome is uncertain [4]. Both models have their own strengths and weaknesses, and the choice of which to use depends on the specific needs of the product development project[5].

The V-model, also known as the Verification and Validation model, is a sequential development process that mirrors the shape of a V. It is similar to the waterfall model in that each stage must be completed before

moving on to the next, but it includes a corresponding testing phase for each stage of development[3]. This allows for continuous testing and validation throughout the development process, ensuring that the product meets the customer's requirements and specifications. The V-model emphasizes the importance of verification (checking the product meets the requirements) and validation (ensuring the product meets the customer's needs) in the development process.

The V-model is commonly used in regulated industries, such as aerospace, defense, medical devices, and pharmaceuticals, where strict quality and regulatory standards must be met. The focus on verification and validation in the V-model makes it well-suited for these types of organizations, as it helps ensure that the product meets the necessary requirements and standards. Additionally, the documentation and traceability of the development process in the V-model can be useful for demonstrating compliance with regulations.

The V model is considered to be more rigid because it follows a linear and sequential process, similar to the waterfall model[7]. This means that each stage of the development process must be completed before moving on to the next stage, with limited room for iteration and flexibility. This can make it difficult to adapt to changes in requirements or to incorporate feedback during the development process. So we need a new model with is more agile with ontinuous testing and validation throughout the development process

2 Waterfall Model

Waterfall model[8] is a sequential product development model where development is seen as flowing steadily downwards (like a waterfall) through the phases of Requirements, Design, Implementation, Verification (Testing), and Maintenance. Each phase of development is completed before the next phase starts, and there is no overlap between phases. This model is suitable for projects where requirements are well-understood and unlikely to change, and where the product can be delivered as a single, integrated solution. In the Waterfall model, testing and documentation are performed at the end of each phase, which can lead to a higher cost and longer timeline due to the late discovery of defects. The lack of involvement of the testing team from the beginning of the project can result in a higher number of defects being found during the testing phase, leading to additional time and effort required to fix the issues. This can make the Waterfall model less efficient and flexible compared to other development models that incorporate testing and feedback earlier in the process.
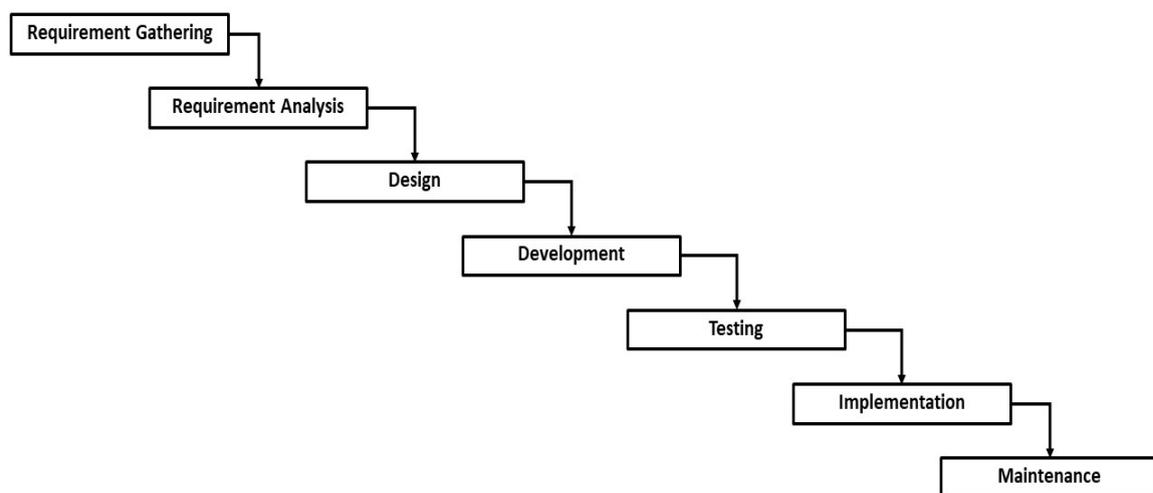
Figure 1: Waterfall Model Life Cycle

In the Waterfall model, the testing engineer's role is primarily focused on the testing phase, and it is assumed that the requirements provided by the client are clear and complete. Requirements are considered frozen once the design phase starts, and any changes to the requirements are not usually considered. This inflexibility in changing requirements can lead to challenges in the development process if there are unforeseen changes or issues that arise during the development.

3 V-Model

The V-model, also known as the Verification and Validation (V&V) model, is a product development lifecycle model that is similar to the Waterfall model[9]. However, the V-model adds a layer of testing and validation to the traditional Waterfall model. In the V-model, each phase of the product development process is matched with a corresponding testing phase to ensure that the product meets the requirements and specifications. The V-model is a balanced developmental process that relies on the verification from previous steps before proceeding forward. In this model, each phase of the development process is matched with a corresponding testing phase, and the product from every phase needs to be checked and approved before moving forward. This approach helps to ensure that the product meets all requirements and specifications, and any issues are caught and addressed early in the development process.
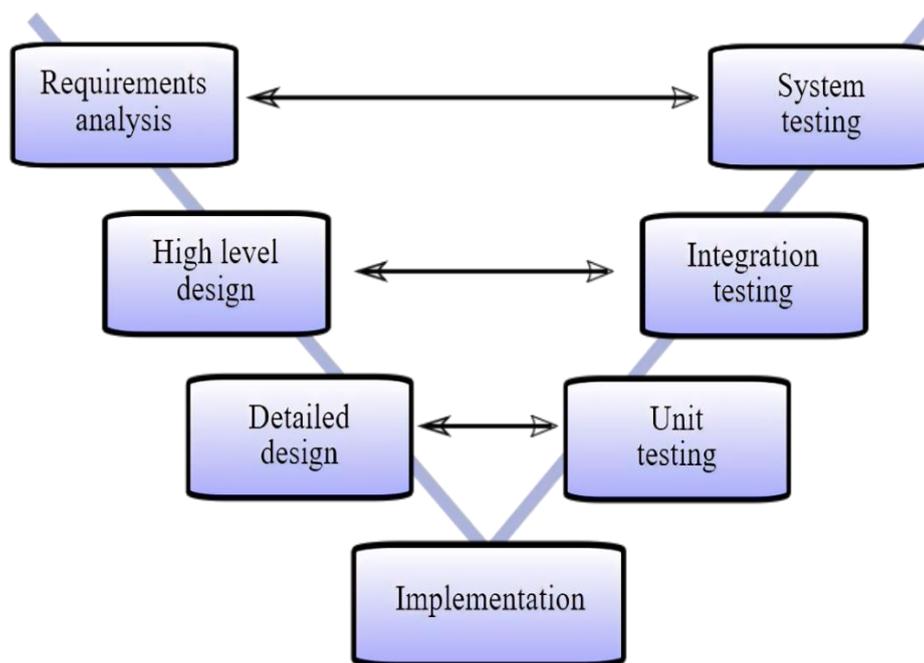

Figure 2: V-Model Life Cycle

The V-model emphasizes the importance of thorough testing and validation at every stage of the development process. This helps to minimize the risk of errors or issues arising later in the project, which can result in significant costs, delays, or even safety risks. The V-model also ensures that all stakeholders, including the development team, the testing team, and the customer, are aligned and involved in the development process. This helps to ensure that the product meets the needs and expectations of all stakeholders, and that any changes or requirements are identified and addressed in a timely manner. The V-model provides a clear relationship between each development stage and testing stage. The V-model matches each stage of the

development process with a corresponding testing stage, ensuring that the product is thoroughly tested and validated at every stage of the project.

4   Agile Model

The term "agile" stands for "moving quickly" and refers to a flexible, adaptive approach to product development. Agile methodology is a iterative and incremental approach to product development that emphasizes flexibility, collaboration, and constant adaptation to change[10]. In agile development, the development team works closely with the customer to prioritize and deliver the most important features of the product in each iteration. The customer can provide feedback and request changes at any time, and the development team is able to respond to these changes quickly and effectively.

The Agile methodology is focused on delivering customer satisfaction by rapid delivery of a useful prototype. One of the key principles of Agile is that it welcomes changing requirements, even late in development. This allows the development team to respond quickly and effectively to changing customer needs and expectations. Another key principle of Agile is that working prototypes are delivered frequently, typically in weeks rather than months. This helps to ensure that the customer is able to see the progress of the project and provide feedback in a timely manner.
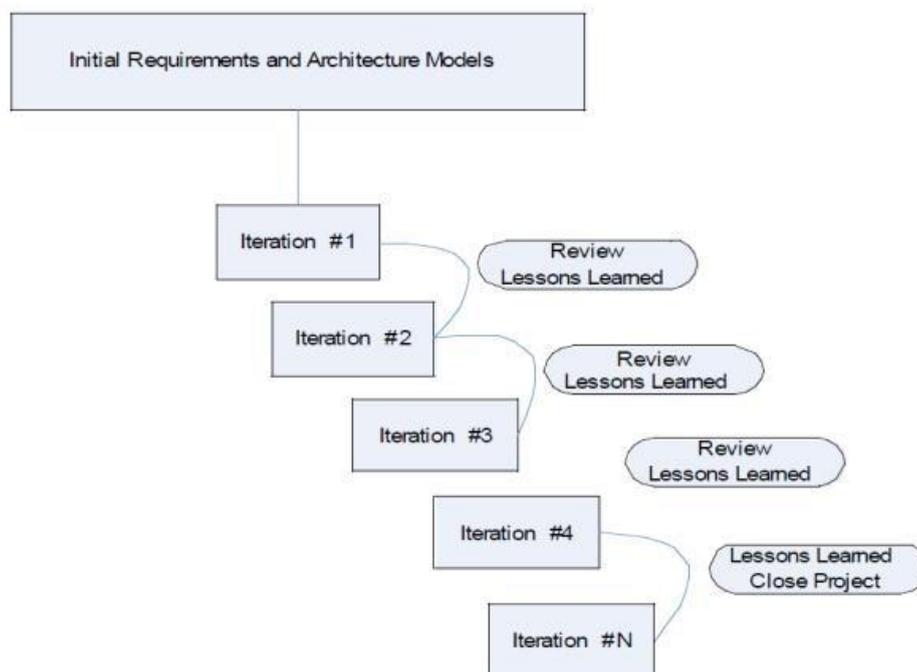
Figure 3: Agile Model Life Cycle

The most important of the principles is customer satisfaction, which is achieved by giving rapid and continuous delivery of small and useful product increments. In Agile development, the focus is on delivering functional product/prototype as quickly as possible and then iteratively improving it based on feedback from the customer. This helps to ensure that the product meets the needs and expectations of the customer, and that any changes or requirements are identified and addressed in a timely manner.Overall, the Agile approach helps to improve customer satisfaction by delivering product that meets their needs and expectations, in a rapid and flexible manner.

3 V-Model and System Engingineering

V-model can be adapted for use in system engineering[11]. In system engineering, the V-model is often used to develop complex systems such as aerospace systems, defense systems, or medical devices. The V-model can be applied to system engineering projects to ensure that all aspects of the system, including hardware, software and processes, are thoroughly tested and validated to meet requirements and specifications.

In system engineering projects, the V-model can be adapted to include specific steps for system integration, testing of individual components, and overall system testing. The V-model can also be modified to include steps for risk management, safety assessment, and certification.
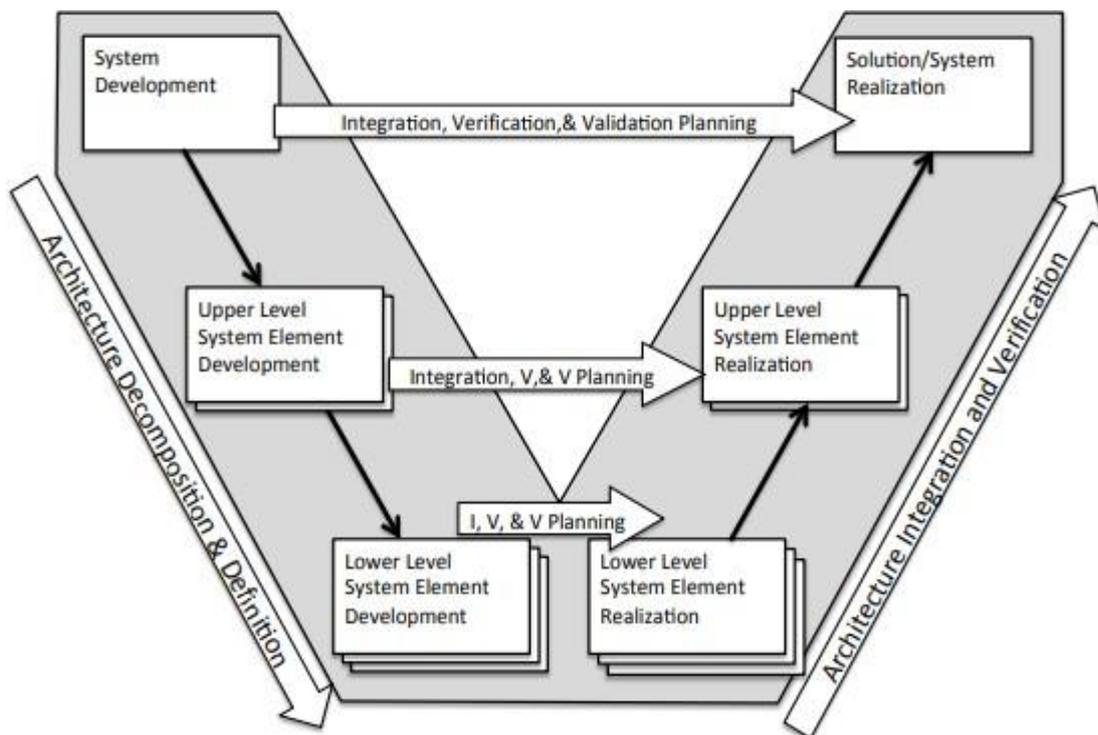
Figure 4: System Engineering V-Model Source: (INCOSE, 2011)

By using the V-model in system engineering, stakeholders can ensure that the system meets all requirements and is thoroughly tested before deployment. This helps to minimize the risk of unexpected problems or issues arising after deployment, which can result in significant costs, delays, or even safety risks.

The rigid, sequential nature of the System V model can make it difficult to use in an Agile context. Agile teams often find it challenging to fit their iterative, incremental work into the rigid structure of the System V model. Additionally, the System V model can be too time-consuming and slow for Agile teams, who need to deliver value quickly and frequently. To overcome these challenges, some organizations have adapted the System V model to make it more compatible with an Agile approach. For example, they may incorporate Agile principles and practices into each stage of the System V model, or they may use an Agile methodology, such as Scrum, to manage their projects. In conclusion, while the System V model can be difficult to use in an Agile context, with the right adaptations and approach, it can be made to work effectively in an Agile environment.

4 Zhivete Model

This paper is proposing a new model named Zhivete model , this methodology that combines elements of the V model and Agile Scrum methodology at different phases of the development cycle. The model is named after the Glagolitic letter "Zhivete,"() which is the oldest known Slavic alphabet.snice the model looks similar to the letter (Zhivete), from the Glagolitic script (the oldest known Slavic alphabet).

The V model is a process that emphasizes a structured approach to testing and verification, with each phase of development having a corresponding phase of testing. The Agile Scrum methodology, on the other hand, is an iterative approach to product development that emphasizes collaboration, flexibility, and adaptability.

Combining elements of these two methodologies in the Zhivete model could potentially provide a more structured and systematic approach to product development, while also allowing for flexibility and adaptation to changing requirements and user needs. The proposed Model is shown the figure 5.
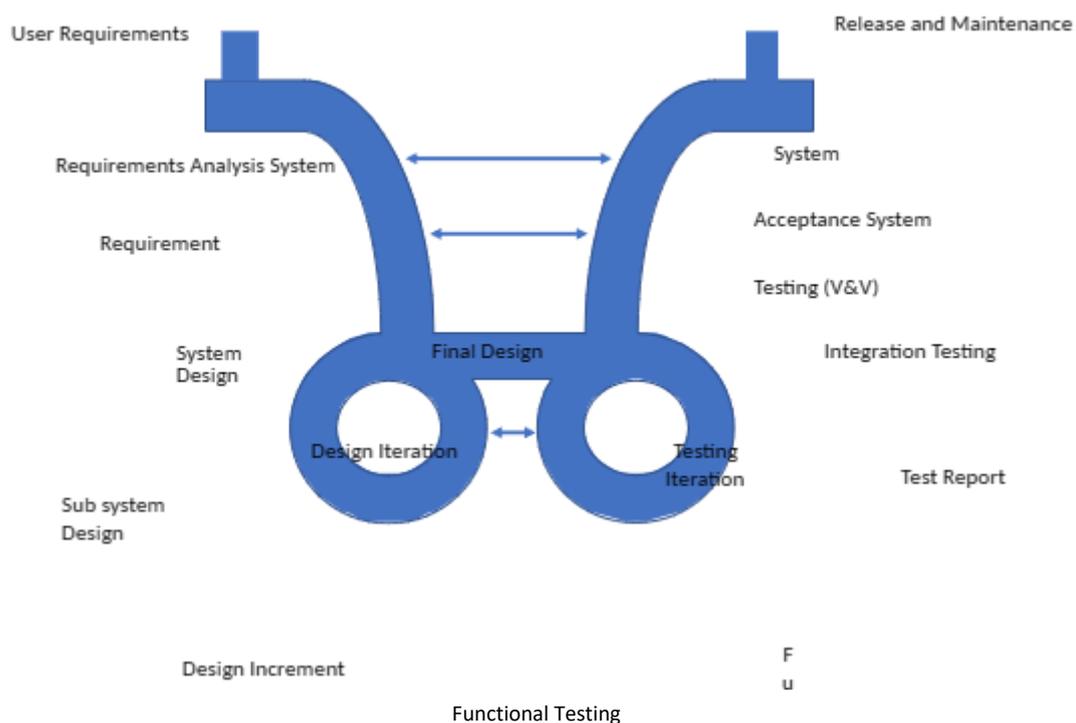
Figure 5: Proposed Zhivete Model

One of the advantages of the Zhivete model is that it follows a structured approach from user requirements to system design, which is similar to the V model. This can provide a more predictable and controlled process for development, especially in larger or more complex projects. However, the Zhivete model also incorporates an iterative approach during the design phase, which is similar to the Agile Scrum methodology. This can allow for more flexibility and adaptability during the development process, which is important in today's fast- paced and constantly changing business environment.

In addition, by simultaneously testing and designing in increments, the Zhivete model can help to identify and address issues earlier in the development process, which can help to reduce the cost and time required for testing and debugging later on. Overall, the hybrid approach of the Zhivete model could offer a balance

between the structure and predictability of the V model and the flexibility and adaptability of Agile Scrum, which could make it a useful methodology for product development teams to consider.

Once the design convergence is achieved, the model will fall back to the V model approach to continue with integration testing, system verification, and validation. This can help to ensure that the product meets the acceptance criteria and is functioning as expected. The V model is known for its structured approach to product testing and verification, with each phase of development having a corresponding phase of testing. This can help to ensure that the product meets the requirements and is free of defects before it is released to the customer or end-user. By combining the strengths of both the V model and Agile Scrum methodology, the Zhivete model could provide a comprehensive and effective approach to product development.

5. Summary

This paper describes four product development models: the Waterfall model, the V-Model, the Agile model and the proposed Zhivete model. The Waterfall model is a sequential model in which each phase of development is completed before the next one begins. The V-Model adds a layer of testing and validation to the traditional Waterfall model. The Agile model is an iterative and incremental approach that emphasizes flexibility, collaboration, and constant adaptation to change. The V-Model can be adapted for use in system engineering, ensuring that all aspects of the system, including hardware, product, and processes, are thoroughly tested and validated to meet requirements and specifications.

The Zhivete Model is a hybrid product development methodology that combines elements of the V model and Agile Scrum methodology. It offers a structured approach to development with flexibility and adaptability, allowing for early issue identification and reduced testing costs. Once design convergence is achieved, the model follows the V model approach for integration testing, system verification, and validation. **6 Conclusion**

Zhivete model proposes a hybrid approach to product development that combines the structured and predictable approach of the V model with the flexibility and adaptability of the Agile Scrum methodology. The Zhivete model incorporates an iterative approach during the design phase and emphasizes collaboration between team members. By simultaneously testing and designing in increments, the model can help identify issues early on in the development process, reducing the cost and time required for testing and debugging later. Once the design convergence is achieved, the model falls back to the V model approach for integration testing, system verification, and validation, ensuring that the product meets acceptance criteria and is functioning as expected. Overall, the hybrid approach of the Zhivete model could provide a balance between structure and predictability and flexibility and adaptability, making it a useful methodology for product development teams to consider.

Data availability statement

The authors confirm that the data supporting the findings of this study are available within the article [and/or] its supplementary materials.

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