

# **Work Standardization in IT Project Management Using Agile Methodologies.**

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## **Abstract**

There are many project management methodologies which can be selected while starting new projects. The purpose of this paper is to compare most popular methodology Agile and Waterfall. This paper will determine which is the most suitable for a website development project. Every project is different and requires to be handled differently. Hence, it is better not to grip on one particular methodology. conclude that there is no best methodology when it comes to select the methodology for a website project, a numerous factor needs to be accounted while choosing methodology to go with. Waterfall will be a better solution for small projects that have well-defined requirements that will not change, while Agile is preferred when continuous delivery and feedback are important.

## **Keywords**

Agile, agile methodology, scrum, scrum methodology, Waterfall and waterfall methodology.

## **1. Introduction**

IT project management methodologies can be traditional and agile, and the choice of some of them depends on the nature and characteristics of the project tasks. Agile project management methods have been used for several years. Customer needs, project risk, project size, cost, and project complexity must be considered when deciding which project management method to use (Raj and Sinha, 2020). The paper compares traditional and agile approaches based on scientific literature and data and concludes which methodology is suitable for web development tasks (Thesing et al., 2021).

The waterfall model is the division of project activities into parallel successive phases, where each phase depends on the results of the previous one and corresponds to the specialization of tasks (Journal and Chandrika, 2021). Agile methodology is a practice that encourages continuous iteration of development and testing throughout the software/web development life cycle of a project. In the Agile model, unlike the Waterfall methodology, development and testing activities take place in parallel (Rather and Bhatnagar, 2015).

### **1.1 Objectives**

The purpose of this paper is to compare the most popular methodology - Agile and Waterfall. In IT projects agile methods are better choice than traditional methods this paper will suggest which method is best suitable for your website development project with help of real case studies.

## **2. Literature Review**

Waterfall methodology is a sequential design process and is used in website development. This methodology shows a process that flows smoothly, exactly like a waterfall, through all phases of a project, such as conception, initiation,

analysis, design, development, testing, implementation, delivery, and maintenance. This concept of this model comes from the manufacturing and construction industry. Waterfall also known as the classic lifecycle model, all phases of the waterfall model are independent of each other, and developers must complete each phase before the next phase can begin (Ahmed and Chukwu Ogbu, 2021).

Waterfall methodology has some limitations and weaknesses that need to be handled with care. It does not work well in projects that have a high degree of uncertainty, where it is very difficult, if not impossible, to predict project requirements in advance. It forces you to make a lot of assumptions about the requirements based on speculation, and often those assumptions are wrong (Grebić, 2019).

Agile is an iterative approach to project management and software development that helps teams deliver value to their customers faster and with fewer errors. The word "agile" is used in project management to describe the mindset, values, and ability to change and succeed in a complex business environment (Kumar et al., 2014). The use of agile in project management emphasizes the importance of coordination. The purpose of this study is to use APMF (Agile Project Management Fundamentals), which contains the main agile methods to face difficulties and challenges in the waterfall development model. The development team, support team, and client can work together within APMF to maintain a positive interaction (Barraood et al., 2021).

These methodologies primarily focus on real-time, face-to-face communication to minimize risk and address rapidly changing customer demands. This methodology focuses more on people, customer interaction and collaboration instead of process tools and plans. Agile methodology is based on frequent contact with clients and users, which means that cooperation with clients is the most important for the success of the project (Rajan and Santhosh, 2021).

An agile approach suggests that we should be flexible and adaptable to changes because the directions of project development cannot be predicted into the future. The business environment is constantly changing, as well as the users themselves, who change their requirements in relation to the functioning system (Špundak, 2014).

### **3. Methods**

In project management, especially when it comes to website development, using an appropriate project management methodology is vital. As a project manager, he chooses the appropriate method to help your team's processes while finding the process that best fits your use case.

Using each of the two most popular project management methods - Scrum and Waterfall has different advantages. Choosing one or the other could very much depend on the type of project or organizational goals, but both approaches are currently actively used in the software development process (Vresk et al., 2020).

The real case study is taken from e-commerce industry to compare the waterfall and scrum approach to complete this website development project. The first it is solved by traditional waterfall approach and same case study is solved with agile scrum approach. so this study aims to show that which is best suitable method for completion website development project. The next session of paper explain comparison between waterfall and agile scrum approach ending with the conclusion of this case study.

Case study - For a new e-commerce website to launch, the highest business value will be when a new user is able to buy an item from the website.

#### **3.1 In first approach case study solved with waterfall approach which consist of 5 stages (Figure 1).**

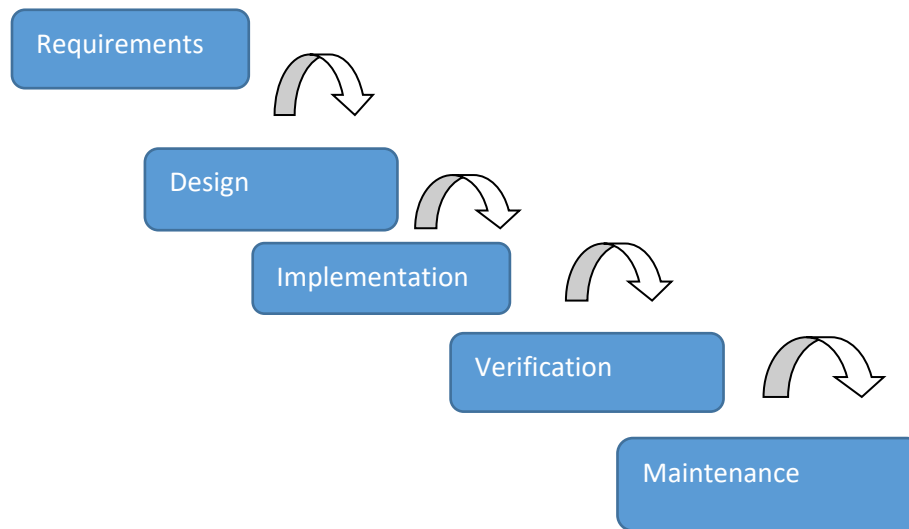


Figure 1. Waterfall Model

1. Requirements – This is the gathering of all customer requirements before the start of the project that enables the planning of each following phase (Bhavsar et al., 2020)

2. Design – This includes logical design and physical design: brainstorming solutions and turning them into specifications

3. Implementation – When developers take all requirements and specifications and write the code for them

4. Verification – Releasing the product/solution to the customer so they can review it and make sure it meets the requirements.

5. Maintenance – The customer starts regularly using the finished product, reporting, and tracking bugs or features that do not work so the production team can fix them.

### **3.2 In second approach case study is solved with agile scrum approach**

Below Figure 2 shows the scrum framework used in agile. The Scrum framework consists of Scrum Teams and their associated roles, events, artifacts, and rules. Each component within the framework serves a specific purpose and is essential to Scrum's success and usage.

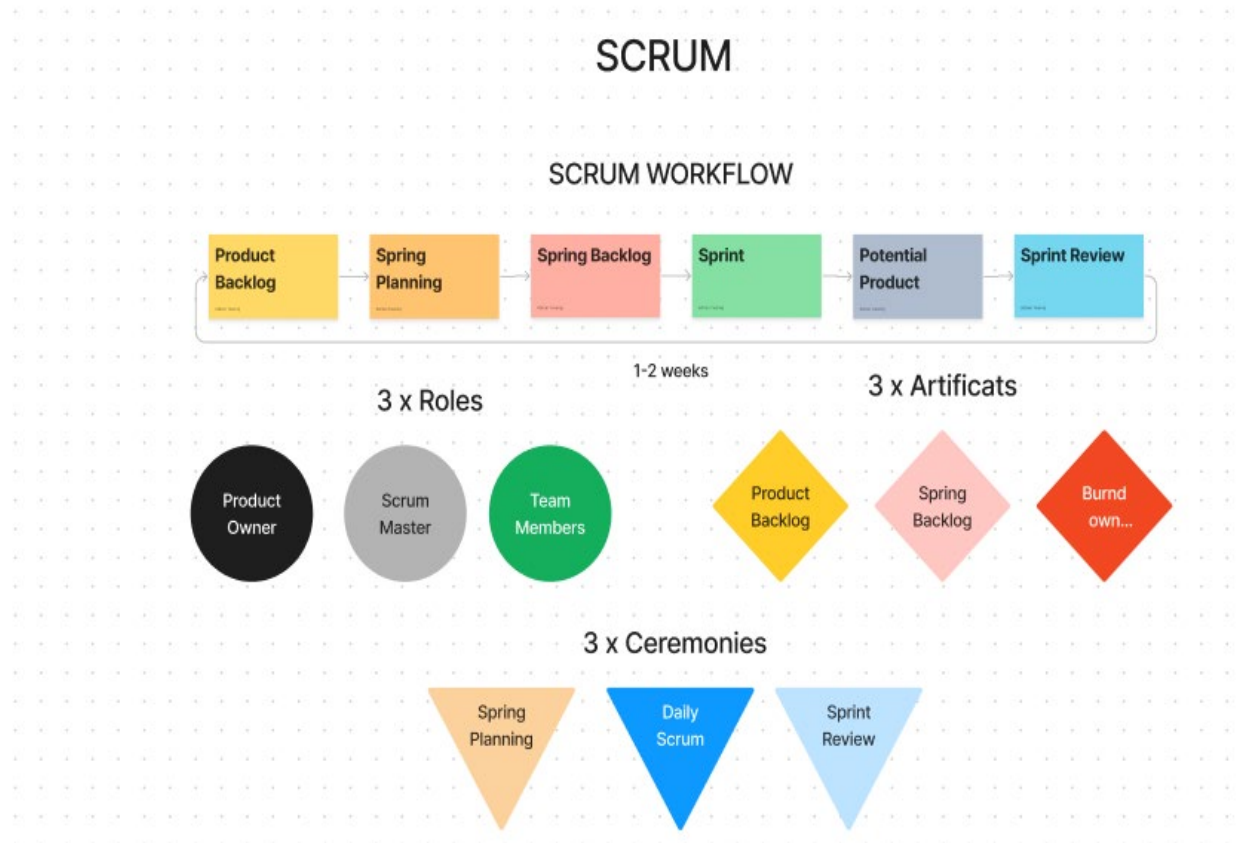


Figure 2. Scrum Framework

The Scrum methodology has three basic roles. The main roles are those committed to the project: Product Owner, Development Team, and Scrum Master. Each of them has a responsibility. For example, the product owner represents the stakeholders. The owner ensures that the team brings value to the business. The development team is responsible for delivering potentially transferable increments at the end of each iteration, and the Scrum Master acts as a buffer between the team and any distractions. He assured that Scrum was being used as intended and the project was on track (Sinha and Das, 2021).

Scrum is an iterative incremental process and scrum is the most common agile approach. assigned tasks. Scrum is based on work in progress to be completed in the next iteration (Fustik, 2017). Here in the scrum the "client or end user" works closely with the development team to identify and prioritize system functionality in the form of a "product backlog".

**Sprint Backlog:** A sprint backlog is a list of backlog items assigned to a sprint but not yet completed. Ideally, it is recommended that no sprint backlog item takes more than two days to complete. The sprint backlog helps the team predict the level of effort required to complete the sprint and meet the goals that were set before any sprint is implemented.

At the beginning of each project sprint, the backlog is shared between team members and people on the client side to decide the scope of the next release. Each sprint aims to fix the backlog of bugs brought into it from the previous sprint. Before implementing each sprint, team members identify the backlog for the sprint. After the sprint is completed, the team reviews the sprint to gain insights in the form of lessons learned and evaluate progress. daily small team meetings are recommended in the scrum. These small meetings are called scrums. During these scrums, each team member describes the work to be done that day, progress from the previous day, and any blocks that need to be removed. These meetings will be formal but in an informal setting, so the scrum is expected to be conducted with everyone in the same room – standing for the duration of the meeting. When enough of the backlog is

implemented that end users believe the release is worth putting into production and that there is nothing left to deal with, management closes development. The team then writes the code, performs integration testing, training, and small documentation as needed for the product release(Kaur and Kumar, 2015).

Sprint is the name for small iterations in which modules are broken up to break down the complexity of the product. In this case study, 1 sprint length is considered to be 1 week with 5 working days. A story point in a scrum is a unit of measure to calculate the estimated effort to complete a story, in this case study 1 story pint is considered 1 hour. These sprints are decided immediately after the broad scope and top product design is completed. After in-depth analysis and number of stakeholder meetings, no more additional services can be added to the final sprint product after the sprint backlog is completed. After the sprint is delivered, its backlog will be analyzed again, and priorities are reset according to the required changes. Scrum is quite useful for dealing with rapid changes at various stages of product development(Gaborov et al., 2021).

Burn down chart is as important in scrum as project speed. Updated daily, this chart shows full details of the sprint's progress and is used to check the status of the work remaining in the sprint. The stock chart is used both to monitor the progress of the sprint and to decide when items must be removed from the sprint backlog and deferred to the next sprint (Singh et al., 2019).

#### 4. Results and Discussion

The results are compared for both waterfall and scrum methodology with help of case study. From the case study we see that waterfall model takes 35 hours to complete this project. However agile scrum approach has taken 29 hours to complete this project in this research we tried to highlight the possibility of adopting agile methods to be suitable over traditional methodology while completing the IT projects. Below table 1 shows time taken by each stage of waterfall to complete this project. Total time taken by waterfall approach to complete the task is 35 Hours.

Table 1. Stages In waterfall model

Sr No	Stages	Time (Hours)
1	Requirements	10
2	Design	9
3	Implementation	8
4	Verification	3
5	Maintenance	5
	Total	35

For Agile scrum approach below are the results. The total time to complete this project with agile scrum approach for this project is total 29 hours. The Figure 3 shows Information regarding product backlog prioritized list of deliverables (such as new features) the epic is collection of user stories that should be implemented as part of a project or product development.

Epic	User Story ID	Feature	User Story	Status	Acceptance Creteria
For a new e-commerce website to launch,the higher Business Value will be when a new customer is able to buy an item from the website.	US001	First time visitor can make the payment as guest user without having to register	As a First time user to the e-commerce website, I want to be able to buy listed product, So that I can use the product that I buy.	New	Guest User should be able to login on website with valid data.
	US002	New user can register on website	As a first time user to the website,I want to be able to registeron the website,So that I can browse and buy listed products fro the website.	New	New user should be able to register account with valid data.
	US003	Registered user can browse items listed	As a registered user,I want to able tobrowse listed products,from the website,So that I can make my choice and buy a listed product from website.	New	User Should be able to browse the products
	US004	Registered user can add items to the cart	As a registered website user, I want to be able to add items in cart,So that I can buy a listed product from the website.	New	User should be able to add the items in cart
	US005	Registered user can make payment for the items added to the cart.	As aregistered website user, I want to be able to buy listed productst.So that I can use the product I buy	New	User should be able to make the payment after adding products to cart

Figure 3. Product Backlog Chart

The figure 4 shows sprint backlog helps the team predict the level of effort required to complete the sprint and meet the goals that were set before any sprint is implemented.

Epic	User Story ID	Feature	User Story	Story Point	Sprint
For a new e-commerce website to launch, the higher Business Value will be when a new customer is able to buy an item from the website.	US001	First time visitor can make the payment as guest user without having to register	As a First time user to the e-commerce website, I want to be able to buy listed product, So that I can use the product that I buy.	8	1
	US002	New user can register on website	As a first time user to the website, I want to be able to register on the website, So that I can browse and buy listed products from the website.	3	2
	US003	Registered user can browse items listed	As a registered user, I want to be able to browse listed products, from the website, So that I can make my choice and buy a listed product from	5	2
	US004	Registered user can add items to the cart	As a registered website user, I want to be able to add items in cart, So that I can buy a listed product from the website.	5	3
	US005	Registered user can make payment for the items added to the cart.	As a registered website user, I want to be able to buy listed product. So that I can use the product I buy	8	3

Figure 4. Sprint Backlog Chart

Burn down chart is as important in scrum as project speed. Updated daily, this chart shows full details of sprint's progress and is used to check the status of the work remaining in the sprint (Figure 5).

Sprint Burndown Chart																	
User Story ID	Feature	Initial Estimate	Jun-04	Jun-05	Jun-06	Jun-07	Jun-08	Jun-11	Jun-12	Jun-13	Jun-14	Jun-15	Jun-18	Jun-19	Jun-20	Jun-21	Jun-22
		Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
US001	First time visitor can make the payment as guest user without having to	8		4			4										
US002	New user can register on website	3						1	1	1							
US003	Registered user can browse items listed	5							1	1		1	1		1		
US004	Registered user can add items to the cart	5												1	2	1	1
US005	Registered user can make payment for the items added to the cart.	8															2
Remaining Effort		29	29	25	25	25	21	19	17	16	15	14	11	8	5	2	0
Ideal Trend		29	27.06667	25.13333	23.2	21.26667	19.33333	17.4	15.46667	13.53333	11.6	9.66667	7.73333	5.8	3.86667	1.93333	0

Figure 5. Burndown Chart

#### 4.1 Graphical Results

The comparison of waterfall and scrum model has been done in with help of case study. The result is shown in below table. From the case study we see that waterfall model takes 35 hours to complete this project. However agile scrum approach has taken 29 hours to complete this project (Figure 6).

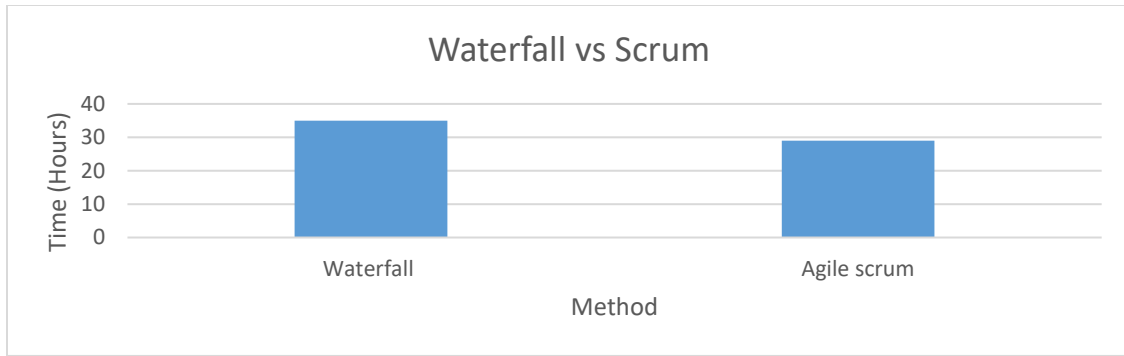


Figure 6. Comparison of Waterfall vs Scrum

According to statistics presented in the annual State of Agile report developed by Digital.ai, highlighted scrum as the most popular agile approach with 66% software projects done with this methodology (Digital.ai The 15 th Annual State of Agile Report 2021). As shown in Figure 7. However, this statistic should not influence the decision-making of project managers in choosing the appropriate implementation method

The Scrum methodology is a subset of the Agile methodology and the most popular process framework that implements Agile. Scrum is a method that works great for complex and innovative projects and brings solutions with a focus on project management(Sharma and Hasteer, 2017).

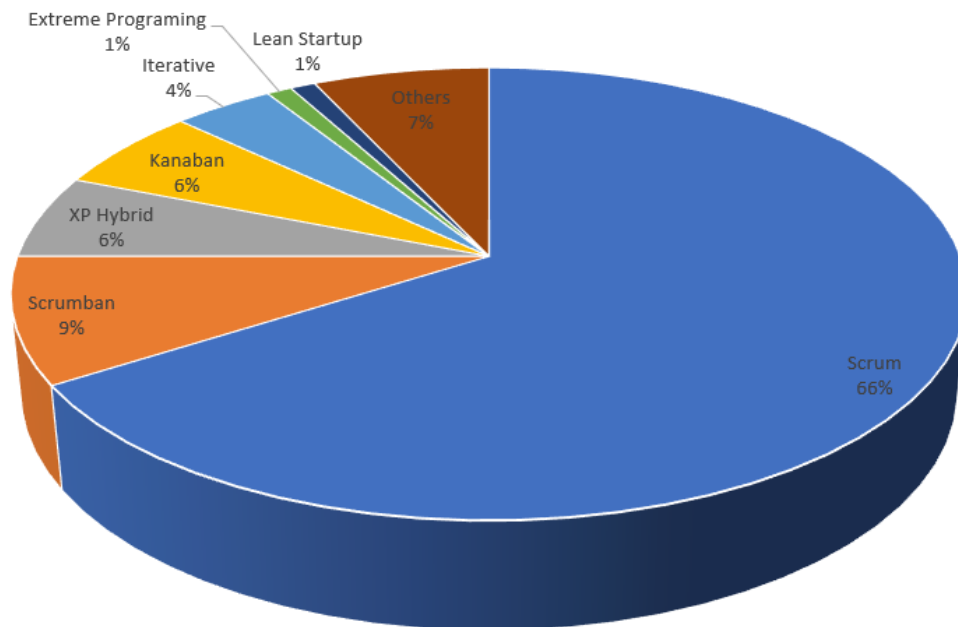


Figure 7. Agile methodologies used by companies for implementing software projects.

## 5. Conclusion

It can be concluded that Agile and Waterfall methodology has its own strengths and weaknesses. As such, there is no solution for all types of website development projects. Various factors like the Client Requirements, number of people in the team, project completion timeline, how inclined to changes the requirements are or the duration of the project should be considered. Therefore, it was observed that most projects that used Waterfall are small projects, having teams of less people and in the results of the study, the most popular methodology is Agile, using Scrum. In conclusion,

the methodology chosen depends on each team and must be picked specifically for that project tasks, as no approach can satisfy all needs. The tendency is that Waterfall methodology is used mostly in small projects tasks that have well defined requirements, while Agile methodology is more flexible and preferred when continuous feedback is important.

## References

- Ahmed, L., and Chukwu Ogbu, R . A Comparative Analysis of Agile and Waterfall Software Development Methodologies. *Bakolori Journal of General Studies*, vol.11,no.2, pp.3201–3210, 2021.
- Barraood, S., Mohd, H.,F. B.-C. (KMICe) V.A Comparison Study of Software Testing Activities in Agile Methods. *Soc.Uum.Edu.My, February*, 2021.
- Bhavsar, K., Shah, D. V., and Gopalan, D. S . Scrumbanfall: An Agile Integration of Scrum and Kanban with Waterfall in Software Engineering. *International Journal of Innovative Technology and Exploring Engineering*, vol.9,no.4, pp.2075–2084, 2020.
- Digital.ai The 15 th Annual State of Agile Report 2021 (<https://digital.ai/resource-center/analyst-reports/state-of-agile-report>).
- Fustik, V. Scrum Methodology Compared With Other Methodologies Applied in the Software Development Projects. *Proceedings of the International Conference on Information Technologies, September.7–16*, 2017.
- Gaborov, M., Karuović, D., Kavalić, M., Radosav, D., Milosavljev, D., Stanisljev, S., and Bushati, J.Comparative analysis of agile and traditional methodologies in IT project management. *Journal of Applied Technical and Educational Sciences*, vol.11,no.4,pp.1–24, 2021.
- Grebić, B . Traditional vs Agile Project Management in the Service Sector. *European Project Management Journal*, vol.9,no.2,pp.55–63,2019.
- Journal, I., and Chandrika, F. M.*Agile against conventional approaches of SDLC*. 2021.
- Kaur, C., and Kumar, V . Comparative Analysis of Iterative Waterfall Model and Scrum. *FP-International Journal of Computer Science Research*, vol.2,no.1,pp.11–14, 2015.
- Kumar, R., Gupta, A., and Singh, H . Agile Methodologies: Working Mechanism with Pros and Cons. *Gian Jyoti E-Journal*, vol.4,no.2,pp.18–27, 2014.
- Raj, P., and Sinha, P.Project management in era of agile and devops methodologies. *International Journal of Scientific and Technology Research*, vol.9,no.1, pp.1024–1033, 2020.
- Rajan, E. R., and Santhosh, V. A. Adoption of Agile Methodology for iMproving it project perfoRmance. *Serbian Journal of Management*, vol.16,no.2, pp.301–320, 2021.
- Rather, M. A., and Bhatnagar, V. *A comprative study of sdlc model*. vol.4,no.10,pp.23–29, 2015.
- Sharma, S., and Hasteer, N.A comprehensive study on state of Scrum development. *Proceeding - IEEE International Conference on Computing, Communication and Automation, ICCCA*, pp.867–872, 2017.
- Singh, R., Kumar, D., and Sagar, B. B.Analytical Study of Agile Methodology in Information Technology Sector. *2019 4th International Conference on Information Systems and Computer Networks, ISCON 2019*, pp.422–426, 2019.
- Sinha, A., and Das, P. Agile Methodology Vs. Traditional Waterfall SDLC: A case study on Quality Assurance process in Software Industry. *2021 5th International Conference on Electronics, Materials Engineering and Nano-Technology, IEMENTech* , 2021.
- Spundak, M.Mixed Agile/Traditional Project Management Methodology – Reality or Illusion? *Procedia - Social and Behavioral Sciences*, vol.119, pp.939–948, 2014.
- Thesing, T., Feldmann, C., and Burchardt, M.Agile versus Waterfall Project Management: Decision model for selecting the appropriate approach to a project. *Procedia Computer Science*,vol.181, pp.746–756, 2021.
- Vresk, A., Pihir, I., and Furjan, M. T.Agile vs. Traditional Methods for Managing IT Projects-A Case Study. *Central European Conference on Information and Intelligent Systems*, pp.183–192, 2020.

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