

**PROJECT MANAGEMENT TECHNIQUES - WATERFALL AND AGILE  
TECHNOLOGY**

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*Abstract*

*In this research paper, the main goal is to compare the waterfall and agile project management practices in order to understand their pros and cons as well as how they can be used for technology projects. Waterfall approach – The waterfall technique is linear and sequential process that means each step of the project needs to be completed before proceeding to the next step. It's an organized methodology which can be well-suited for projects with clear requirements and relatively static scope since you can plan and document things very carefully. For executing projects in industries, project management is an essential field. Two of the most popular are Waterfall and Agile technology. In this article, we will consider their main tenets, advantages, drawbacks, and use cases. Through knowing these methods, project managers can select the right one to drive maximum efficiency, cooperation and quality in the delivery. Two well-known methodologies for project management are waterfall and the more modern approach called agile. This study aims to determine what the strengths, weaknesses and advantages of both methods are, as well as what the advantage of a hybrid solution that has a bit of both. Project management is one of the most essential functions of today's business since it provides a methodical means to plan, deliver, and complete projects.*

*Keywords : Project management, Agile, waterfall, JIRA, Scrum*

**I. INTRODUCTION**

Prompt project management strategies are a must to ensure that projects are finished on time, within budget, and according to the quality standards. Some of the most popular methods include Waterfall model, which is strictly structured and sequential and Agile technology, which is modular and iterative. There are different methodologies for various kinds of projects and organizations with their own advantages and disadvantages. The waterfall method of project management is more traditional and linear; each project phase needs to be achieved before proceeding to the next [1]. In contrast, agile project management is all about adaptability, teamwork and iterative development to meet changing requirements. [1] [2] Both are equally valid methodologies, but a decision can be made only based on the type of project, the culture of the organization and the degree of incertitude involved.

## **II. PROJECT MANAGEMENT TECHNIQUES**

Project management based on waterfall, for example, is the standard solution used in biggest and complex projects. But these techniques aren't without disadvantages, such as the lack of adaptability to new needs [3]. Unless large project spend has been earmarked for requirements and design work, updates can be very expensive at the end. Agile methodologies such as Scrum and Kanban, on the other hand, are a different paradigm to waterfall. When using agile approaches, you develop something not 100% obvious in the first place, focus on the needs of your clients, don't hesitate to get feedback and embrace changes in requirements as you go. [4]

### **1. Waterfall Model**

The waterfall model is a sequential way to manage a project in which every step (requirements, design, implementation, verification, and maintenance) is complete before proceeding to the next step [3]. This is the planning and design approach that prioritizes planning and design in advance, assuming the requirements are clear and don't shift.

The waterfall methodology is a linear, sequential approach to project management, where each phase of the project must be completed before moving on to the next. This approach emphasizes thorough planning and design upfront, with the assumption that requirements are well-defined and unlikely to change. [3] Waterfall projects typically culminate in a final delivery of the completed system or product to the customer, following the successful completion of all project phases.

### **2. Agile Methodology**

Agile techniques, however, have a much smaller iterative approach, where feedback and changes happen quickly. Agile processes such as Scrum or Kanban stress customer cooperation, iterations and prototyping in order to keep pace with changing requirements [1]. Scrum works great for low-ceremony documents, small sprints, early testing, and a constant customer engagement with volatile requirements. [3] Agile methods differ from waterfall by being more iterative and incremental in nature, and also focusing on rapid feedback and adaptation. Agile approaches such as Scrum and Kanban emphasize customer communication, iteration and early testing to deal with shifting demands quickly.

### **3. Hybrid Methodology**

Traditionally waterfall and agile are both described as the antithesis of each other, but we're beginning to realize that a mix of the two is useful, especially for larger, more complex projects [3][1]. By scrutinizing the way projects are managed and executed, organizations can see which tools and practices to implement ("traditional", "agile" or a combination of both). While waterfall and agile methodologies are often presented as opposing approaches, there is growing recognition that a combination of both can be beneficial, particularly in large or complex projects.

### III. COMPARISON OF WATERFALL AND AGILE

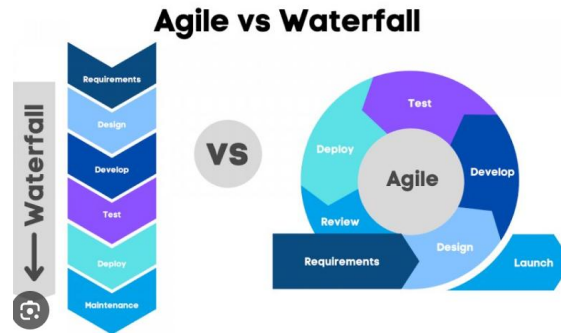


Figure 1 Agile vs Waterfall

### Comparative Analysis

Aspect	Waterfall	Agile
Structure	Linear and sequential	Iterative and flexible
Change management	Difficult to accommodate	Easy to implement
Documentation	Comprehensive and mandatory	Minimal and adaptive
Risk management	Risks identified late in the process	Risks addressed early via iterations
Customer involvement	Limited to initial stages	Continuous and frequent

1. **The waterfall model offers several advantages:**
  - It reduces the loss of any key information and requirements in the initial stages.
  - Increased control throughout each phase
  - Formal planning stage may increase the chances of capturing all project requirements upfront
  
2. **The waterfall model also has inherent drawbacks:**
  - Inflexibility in the face of changing requirements
  - High ceremony documentation not necessary in all projects
  - Changes can be very costly later if large amounts of project resources have been invested in requirements and design activities
  
3. **Agile methodologies offer several key advantages:**
  - Flexibility and responsiveness to changing requirements
  - Early and frequent delivery of working software
  - Increased collaboration with the customer
  - Ability to adapt to evolving needs
  
4. **Some of the disadvantages of agile methods include:**
  - Difficulty in estimating project timelines and budgets upfront

- Emphasis on face-to-face communication can be challenging in distributed teams
- Requires a high level of discipline and commitment from the team

The choice between waterfall and agile methodologies ultimately depends on the specific needs and characteristics of the project. Finally, the decision between waterfall and agile is up to the needs and project type of the project. A combination of both methodologies that is a hybrid solution is best for complex projects, like in healthcare. Stakeholder management, tools and techniques and a focus on continual improvement are all aspects of effective project delivery, whether you opt for a specific approach or not.

#### **IV. REQUIREMENT AND PROJECT PLAN**

When building waterfall, the set of requirements has to be standardized, iterated on, and then designed. It assumes that the requirements are clearly understood and won't evolve during the life of the project. The waterfall methodology requires a comprehensive project plan to be developed at the outset, outlining the timeline, resource allocation, and key milestones. The execution of a waterfall project involves strictly following the predefined plan, with each phase being completed in a linear fashion before moving to the next. Waterfall projects employ formal processes for monitoring and controlling the project, with regular status updates and change control mechanisms in place.

The Agile processes, on the other hand, use iterative and incremental development based on rapid feedback and adaptation. Scrum and Kanban also make it a point to work closely with the customer, iterate quickly, and test early in order to take advantage of changing requirements. In agile development, requirements are gathered and refined through an iterative process, with the customer actively involved throughout the project. Agile projects do not require a comprehensive project plan to be developed upfront. Instead, the team plans and commits to delivering a specific set of features within a short iteration, typically two to four weeks. Agile projects employ lightweight monitoring and control mechanisms, such as daily stand-up meetings and burn down charts, to track progress and make adjustments as needed.

#### **V. PROJECT MANAGEMENT IN HEALTHCARE**

Healthcare projects pose unique challenges that require a tailored approach to project management. Healthcare projects often involve complex requirements, regulatory constraints, and the need to balance multiple stakeholder interests. To address the unique challenges of healthcare projects, a hybrid approach combining elements of waterfall and agile methodologies may be the most effective solution. [3] [1] Agile can be implemented in healthcare organisations (although some adaptation will need to be made to the specifics of the healthcare environment). Agile approaches are particularly adaptable and iterative, and this is especially useful in healthcare where needs change quickly and stakeholder demands change. [5] Here are a few points for using agile in healthcare: [1] [5] Agile approach can be used across the whole lifecycle of a project, from initial stage to final stage, as a highly flexible and collaborative process. This agility-based project management is as relevant and helpful for government and public sector projects as it is for big software development projects, which are typically years in duration, complex with multiple

stakeholders and vendors. [5]

What is successful and what doesn't for agile delivery in healthcare [6]: In order to make an agile journey more efficient, it is best to evaluate how healthcare projects are managed and implemented to know which tools and methods to apply. If you're managing complex healthcare projects, it may be best suited for a mix of waterfall, agile and lean methodologies as you will always need to customize every project for each environment.

**Adapting agile methods to the healthcare industry requires addressing several challenges:**

1. **Regulatory compliance and governance requirements:** Healthcare projects often face strict regulatory constraints, which may not align well with the iterative nature of agile.
2. **Distributed and diverse stakeholders:** Healthcare projects typically involve a wide range of stakeholders, including patients, clinicians, administrators, and IT teams, each with different priorities and communication styles.
3. **Flexibility in requirements:** Healthcare needs can evolve rapidly, necessitating a flexible approach to project management.
4. **Integrating legacy systems:** Many healthcare organizations have complex legacy IT infrastructures, which can be challenging to integrate with new agile-based solutions.

To overcome these challenges, healthcare organizations can adopt a hybrid approach that combines elements of waterfall and agile methodologies.

## VI. WHY IT COMPANIES ARE NOT ABLE TO IMPLEMENT AGILE FULLY

While agile methodologies have gained widespread adoption in the IT industry, fully implementing agile can be challenging for several reasons:

1. **Organizational culture and mind set:** Agile requires a fundamental shift in the way organizations think about project management, with a focus on flexibility, collaboration, and continuous improvement.
2. **Legacy systems and technical debt:** Many IT organizations have complex legacy systems and technical debt, which can make it difficult to implement agile practices.
3. **Resistance to change:** Agile represents a significant departure from traditional project management approaches, and some teams may be resistant to the new ways of working.
4. **Lack of experience and training:** Implementing agile effectively requires specific skills and knowledge, which may not be present in all IT organizations.

To address these challenges, IT organizations can take a more gradual, hybrid approach to agile adoption, slowly integrating agile practices and principles into their existing project management frameworks.

This allows them to realize the benefits of agile while also addressing the unique constraints and requirements of their organization.

## VII. PROJECT MANAGEMENT TOOLS

Project management software can help you with waterfall and agile project delivery. If you have a

waterfall project, classic project management tools such as Microsoft Project or Primavera can help in the tracking of phases of the project lifecycle, monitoring and producing reports. The agile project management software, on the other hand, works with agile methodologies as they are collaborative. Jira, Trello, Asana – Agile project management software including backlog management, sprint planning and live tracking of progress are some of the most commonly used agile project management software. In a hybrid project management strategy, companies may deploy both conventional and agile project management software, as per the project requirements and the overall company strategy.

All that matters is that you are selecting the right tools to match the project management approach and that those tools are being utilized properly by the project team.

The role of the project manager is critical in both waterfall and agile project management approaches, though the specific responsibilities may differ:

In a hybrid approach, the project manager needs to be adept at balancing the different project management techniques and ensuring that the overall project objectives are being met.

They must be able to adapt their management style to the specific needs of the project and the team, and to effectively coordinate the various stakeholders involved.

Ultimately, the success of a project, whether it follows a waterfall, agile, or hybrid approach, is heavily dependent on the skills and leadership of the project manager [1] [7] [8].

## **VIII. HOW TO USE JIRA?**

Jira is a popular project management tool that is well-suited for both waterfall and agile project management approaches.

### **1. For waterfall-based projects, Jira can be used to:**

- Create a comprehensive project plan with milestones, tasks, and dependencies
- Track progress and generate reports on project status
- Manage project issues and risks

### **2. For agile projects, Jira provides features that support the agile methodology, such as:**

- Backlog management: Organize and prioritize the product backlog
- Sprint planning: Plan and manage sprints
- Kanban boards: Visualize the workflow and track the progress of tasks

In a hybrid approach, Jira can be used to combine elements of waterfall and agile project management.

### **3. For example, the project manager can use Jira to:**

- Manage the overall project plan and milestones using the traditional project management features

- Organize and prioritize the product backlog using the agile features
- Manage specific work streams or components of the project using Kanban boards

By leveraging the versatility of Jira, project managers can tailor the tool to the specific needs of their hybrid project management approach, enabling them to effectively manage the project and deliver successful outcomes.

#### **IX. SCRUM CALLS AND DAILY STAND UP IN PROJECTS**

Daily stand up calls are a critical component of the Scrum agile framework, and they can also be useful in a hybrid project management approach.

**The purpose of the daily stand up is to:**

- Provide a regular forum for the project team to discuss progress, identify obstacles, and plan for the day ahead
- Foster collaboration and communication within the team

**In a waterfall-based project, the project manager can adopt the daily stand up concept to:**

- Improve visibility and transparency into the project's progress
- Identify and address issues or bottlenecks more quickly

While the format and frequency of the daily stand up may need to be adapted to fit the waterfall approach, the core principles of improved communication, collaboration, and problem-solving can still be applied.

#### **X. LITERATURE REVIEW**

The existing book on project management methodologies discusses the pros and cons of waterfall and agile methodologies. A waterfall project delivery model [9] – It has a sequential, project-by-project delivery model, with clear steps and deliverables. This strategy can work for projects that have clear objectives and fixed scope, since it establishes a plan for the project and execution [1]. But the waterfall approach is less tolerant of changing needs or unanticipated problems.

Agile, on the other hand, is an iterative and team-based process focused on incremental value creation and adapting to change. The Agile practices, like Scrum and Kanban, have become quite common in the software development space because they foster better communication, agility, and productivity. [9] In order to overcome the deficiencies of the waterfall and agile methods, a hybrid project management model has been developed which blends aspects of both methodologies [1].

As a study pointed out, a hybrid can work best in cases of construction work, where the work is so unique and variable that it can't be easily handled through waterfall or agile. The authors outline an idea that combines some elements of waterfall, agile, and lean to create a more efficient and adaptive system for the execution of construction projects [1].

## **XI. CONCLUSION**

The project management approach you choose should be a decision taken according to the need and constraints of the project in question. Both waterfall and agile methodologies are very different, but a hybrid structure that is a blend of both is often the best one when you have complex projects that need to balance structure with fluidity. Project management resides in the Waterfall and Agile approaches with strengths for different situations. Waterfall is good for organizations that have static requirements, but Agile is a must-have in dynamic industries. We can also go for a hybrid, which combines Waterfall's discipline with Agile's agility, to accommodate the different needs of a project. Knowing the difference between the two methodologies allows project managers to make the right decisions and provide the right results.

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