Article

Hybrid Project Management between Traditional Software Development Lifecycle and Agile Based Product Development for Future Sustainability

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Abstract: The purpose of this review is to look at the future sustainability of project management by combining agile methodology and product management. Digital transformation is evolving rapidly, and the question is whether traditional project management is sustainable. To ensure sustainability, a hybrid approach is taken by combining agile methodology to ensure the latest trend in software development approaches are maintained. Agile methodologies were crafted in 2000, but it has only been widely used since 2011 for software development. This paper will focus on the types of agile requirements engineering methods used in the agile framework, used and described in various articles, journals, and studies over the last six years, and how this can be applied together with traditional project management.

Keywords: agile; project management; product management; hybrid

1. Introduction

Project management has become essential in today's fast-paced industry [1], and is now essential to running digital initiatives effectively. In businesses of all sizes, from small and medium to enormous, people rely on project management [2] to complete their projects. However, traditional tools such as the waterfall methodology may not be a sustainable option today as projects are delivered at a fast pace, and quick iterations are preferred where stakeholders can view the project progress [3]. There are now many different project management techniques available globally, and of all project management methodologies, agile is one of the most widely used; 71% of businesses concurred that they frequently, occasionally, or always use agile principles [4].

Hybrid project management combines elements of lean, agile, and more conventional methodologies. The application of lessons learned from these methodologies is used to boost a project's odds of success through lowered expenses, accelerated timelines, improved outcomes, reduced waste, and happier participants. By maintaining the best practices of the traditional approach underlying this model, the hybrid project management model can be developed by applying several other practices, such as exploring different lean design practices in the design phase, lean construction tools and methods in the execution phase, integrating integrated project delivery (IPD) practices into the project lifecycle, and exploiting collaborative agility tools and techniques. Adopting an agile mindset improves output and maximises results, and agility training can foster teamwork and adaptability. The rate of application of the tools and practices of the methods in the hybrid approach changes from project to project based on numerous project-related aspects. However, they are theory-based models that prescribe specific actions, and very little research has been conducted to determine why hybrid initiatives are more effective.

This paper will examine the distinctions between traditional and agile project management and how the two techniques might be combined to create a hybrid approach to product development.
2. Materials and Methods

Content analysis: The open-ended responses to the questionnaire will be analyzed to determine the use of certain words that represent certain emotions. The content was analyzed to draw findings and conclusions (Benoliel).

Literature review: This study was conducted as a systematic literature review based on the original guidelines proposed by Kitchenham (2004). To provide context to the research, previous research papers not older than 6 years were used to find more information about the research topic. Existing research papers were read to identify new information in the research field and to identify gaps in the existing research to prove why further research is necessary. The steps of the systematic literature review method are documented below.

Research method: We used keywords to search focus on “software project development”, “traditional project management”, “agile methodology”, “agile ceremonies” and “advantages” in Science Direct, IEEE, ACM digital library, Springer, IGI Global, research gate, and Taylor and Francis online. The sources of research papers were studied from different sources, as shown in Figure 1, with the highest number of research papers coming from IEEE. Table 1 summarises the literature citations by categories to find out the frequency and trend of research papers conducted in software project management.

Figure 1. Source distribution for studied research paper.

The Following Are the Research Questions Addressed

RQ1. What are the different types of methods used in traditional project management and agile methodologies?
RQ2. How is traditional project management’s change management implemented into agile development and project delivery?
RQ3. How do Agile methodologies manage the timeline and cost aspects of project management?
RQ4. Discussion: Why is there a need for a hybrid approach in project management between agile and Traditional project management methods?
Table 1. Summary of literature citation by topic related to software project management.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description of the Topic</th>
<th>Features of the Topic</th>
<th>List of References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional project management</td>
<td>The application of one’s knowledge, skills, tools, and procedures to the activities of a</td>
<td>Five Phase:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>project in order to fulfill the requirements of the project. All the phases are completed</td>
<td>1. Initiating</td>
<td>[5-8]</td>
</tr>
<tr>
<td></td>
<td>with the direction and support of the project manager and the project team.</td>
<td>2. Planning</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Executing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Monitoring and controlling</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Closing</td>
<td></td>
</tr>
<tr>
<td>Agile methodology</td>
<td>The ability to respond proactively in a dynamic, arbitrary, and continually changing</td>
<td>Agile development methods such as:</td>
<td>[3,5,8-21]</td>
</tr>
<tr>
<td></td>
<td>environment is a component of organizational agility. Organizational agility is the</td>
<td>1. Scrum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>capacity of an organization to be adaptive to changing conditions without being pushed</td>
<td>2. Extreme Programming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to change.</td>
<td>3. Lean</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Driven by a set of principles that are principle-based rather than rule-based</td>
<td></td>
</tr>
<tr>
<td>Software project management—challenges</td>
<td>As a result of utilizing imprecise terminology and jargon, there is ambiguity in both the</td>
<td>1. Communication Management</td>
<td>[1,2,22-25]</td>
</tr>
<tr>
<td>and opportunities</td>
<td>understanding of business benefits and the knowledge of project requirements, as well as</td>
<td>2. Scope management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>projected deliverables and goals.</td>
<td>3. Risk management</td>
<td></td>
</tr>
</tbody>
</table>

3. RQ1: What Are the Different Types of Methods Used in Traditional Project Management and Agile Methodologies?

3.1. Traditional Project Management

Traditional project management is also known as the heavyweight method. It is a linear sequence that includes project initiation, project planning, project execution, project monitoring, and finally, closure of the project [6]. In traditional project management, numerous approaches are presented, such as the waterfall methodology, the spiral model, the incremental approach, fast application development, the V model, etc. Traditional project management focuses on defining the project’s scope and requirements during the initiation phase.

The waterfall methodology breaks down a project into linear sequential tasks, where the deliverables are used in the subsequent phase. In a typical waterfall approach, we are required to complete a phase with an official sign-off before we can move to the next phase [5]. In each phase of the project, a list of tasks with details is prepared, along with the requirements and success criteria. Rapid application development, or RAD, refers to projects with tight deadlines that employ prototyping and integrate high-level development tools and processes. Proponents of RAD assert that it boosts productivity, decreases delivery time, and achieves high utilization due to the level of user participation in the development process. However, RAD projects might fail if the following are not adequately addressed: team selection, project management, and customer support, and the methodology employed.

The spiral model is a risk-driven approach in traditional project management and was introduced in 1986 by Barry Boehm. The spiral model is a combination of the waterfall model and the iterative approach. Similar to the waterfall, in a spiral model, a project is split into several phases. With a spiral model, each phase has its own design goal, and the customer will review the outcome at the end of the phase. The software development process in the spiral model starts with a small set of requirements, and with an additional spiral added, the set of requirements and functionality of the software is expanded. The spiral model begins with project planning, followed by risk assessment, engineering (compile coding, testing, and deployment), and finally, evaluation of the software by the customer [6]. The spiral model is suitable for large-scale projects, where frequent releases are required and costing and risk analysis are crucial.

The incremental model is an approach that slices into small parts, and each part works with the released functionality from the previous part. With this approach, a system can be repeatedly released to customers with incremental functionality. The scope is defined at the beginning of the project and followed by overall project planning. For the incremental model, a recurrence of phases of launching an increment, monitoring and controlling the
increment, and finally closing the increment phase will be repeated until all the increments in the project planning are covered.

The V model is another traditional project management methodology where it is executed in a V-shape sequence. It is an extension of the waterfall model, which is also known as the verification and validation model. By using the V model, each testing phase will have its validation and verification process, and similarly, only one testing phase is executed at a time.

3.2. Agile Methodology

The agile methodology is a method being used in software development. Agile methodologies were introduced in the 1990s [26] to drive transformation in software development and are now widely adopted by many software development organizations [21]. It consists of a set of revolutionary practices which allows a team to manage a project by dividing long wait times into several iterations with shorter cycle times. Each iteration is known as a sprint and consists of four phases: requirement phase, implementation phase, testing phase, and customer review to collect feedback that can be worked out in the next iteration.

There are four core principles:

1. Individuals and interactions over process and tools. Two ways communication among developers and customers is more important than system processes.
2. Working software over comprehensive documentation. Software that is successfully delivered is more important than the process of documentation in software development.
3. Customer collaboration over contract negotiation. Keeping customers in the loop during software development can receive better customer satisfaction than performing contract negotiations with customers.
4. Responding to change over follows a plan. Always ready to adapt and respond to unpredictable changes is better than following a plan.

Agile methodology is widely used in different types of projects, including business process management [9], IoT projects [10], e-Commerce web applications [12], and quality assurance processes in software development [5]. Research papers studied show that the agile methodology is being applied in IT projects and software development projects. Compared with applying the waterfall methodology, the success rate of the IT project is 24% higher [11] and 2 times higher in software development projects [15]. Research studies also show that with agile Scrum projects, products are delivered faster at 37% compared to the waterfall model [9].

Scrum, Crystal, XP, and Kanban [15] are some of the agile methods that are constructed based on the four core principles in agile methodology to suit the different project’s needs. DevOps culture is combined with agile methodology [12] to improve continuous engagement between the operation team and developer team in a project.

Agile Ceremonies

Multiple release cycles and multiple sprints are also possible for each Scrum project. Several meetings must be held repeatedly before, during, and after the sprint cycle [14].

Scrum proposes four ceremonies: the sprint planning meeting, daily Scrum, sprint review meeting, and sprint retrospective meeting [13,18]; three artifacts: the product increment, product backlog, and sprint backlog, as shown in Appendix A. It also proposes three roles: the team, Scrum Master, and product owner.

3.3. Comparison of Traditional Project Management vs. Agile Methodology

An organization will adopt a suitable project management model based on the consideration nature of the project, complexity of the project, control, and deliverables [16] required. Table 2 summarizes the advantages and disadvantages of using traditional project management models and agile models [6,7,11,15,17,19,23].
Table 2. Comparison of traditional project management vs. agile methodology.

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Traditional Project Management</th>
<th>Agile Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>Usable product delivered only at the end of SDLC.</td>
<td>A functional module is available at every sprint.</td>
</tr>
<tr>
<td></td>
<td>Linear sequential steps are easy to follow.</td>
<td>The project is divided into small shorter iterations.</td>
</tr>
<tr>
<td></td>
<td>Scope and requirements are identified in the initial stage of SDLC.</td>
<td>Requirements can be added throughout the process.</td>
</tr>
<tr>
<td></td>
<td>Cost-effective for a small project</td>
<td>Flexible to adopt changes throughout the development process.</td>
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<tr>
<td></td>
<td>Suitable for projects which do not need intense communication.</td>
<td>Higher testing coverage, where confirmation testing is done in each sprint, and more time for iterative testing on versions released on every sprint.</td>
</tr>
<tr>
<td></td>
<td>Quality assurance testing is well structured and documented.</td>
<td>Customers can give feedback and be actively involved in the development phase.</td>
</tr>
<tr>
<td></td>
<td>Only one deliverable at the final product, no concept of part testing is required.</td>
<td>Customers are informed of the new updates that will be applied in the subsequent sprint.</td>
</tr>
<tr>
<td><strong>Disadvantages/Limitations</strong></td>
<td>Not easy to accept changes once the software development is initiated.</td>
<td>Design quality can deteriorate to achieve fast product development and delivery.</td>
</tr>
<tr>
<td></td>
<td>The customer needs guidance from developers during UAT.</td>
<td>Fault tolerance becomes higher as the focus is on responding to changes instead of proper testing.</td>
</tr>
<tr>
<td></td>
<td>Developers need details of the approved specification and requirements</td>
<td>Difficult to be managed if used in complex projects.</td>
</tr>
</tbody>
</table>

4. RQ2. How Is Traditional Project Management’s Change Management Implemented into Agile Development and Project Delivery?

Agile methods differ from traditional methods in that they prioritize feedback and learning, promoting flexibility and collaboration [23]. Instead of a set process, they allow room for a constantly revised and updated plan of action based on outcomes, customer feedback, and the latest results. Even late in the development process, agile accepts changing needs. Agile methodologies harness change for the benefit of the customer’s competitiveness.

Traditional project management has all the requirements upfront, signed, and agreed upon for design and development. Any changes will require an official document to be drafted and signed for an agreement again. This process is quite heavy in admin and delays the development cycle. The same outcome can be achieved in agile for change management because of the following two Agile manifestos.

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.

Therefore, discussion happens in every sprint planning for what has been done and what the next sprint goal is. If the planned work is not desired, then the product owner can change the product backlog for new user stories, and developers will plan those in their Sprint Planning 2 for Sprint Backlog. The time taken for change management to happen in Agile is seamless, and it is baked into part of the Sprint Ceremonies. There are huge cost savings in terms of effort required in traditional vs. Agile [20,27].

There are also other motivating factors that indirectly and directly influence the seamless change management plan in Agile.

- Delivering valuable software as scheduled and continually has the highest priority to satisfy the customer.
- Agile procedures harness change for the competitive benefit of the customer, even when needs alter later in the development stage.
- Throughout the project, business people and developers must collaborate every day.
- Face-to-face communication is the most effective and efficient way to share information with a development team.
- The team adapts and modifies its behavior in response to periodic reflections on how to be more effective.

The downside of seamless change management in Agile can often be misused.
Management or product owners make frequent changes along the project and especially when the change requires scrapping what was previously delivered—this will incur longer development time and increase in cost [21]. While having the option to make quick and easy change management in Agile, this should not be misused for effective and efficient design and development of projects.

5. RQ3. How do Agile Methodologies Manage the Timeline and Cost Aspects of Project Management?

The software effort estimation method is a crucial step in software engineering and is always critical in software development projects. Several elements, including consistency in effort and timeframe estimation, impact whether a project will succeed or fail. The estimation of work during Agile development is one of the most challenging elements of software engineering [27]. The reason being the effort is divided over different sprints, and the features are thin-sliced and developed in small iterations over weeks and months.

In waterfall, the management determines a team member’s potential productivity by estimating how long certain tasks would take, then assigns work based on the team member’s available time. Agile methodology offers a specialized method for assessing a team member’s aptitude. It first delegated tasks to a group of people rather than a single individual, and the theoretical significance of cooperative effort is emphasized by this. Second, it chooses not to express work in terms of effort since doing so would compromise the self-managed team which is required for the methodology to function well. This is a significant shift from the waterfall; Scrum team members choose their tasks based on commitment and degree of complexity, as opposed to a supervisor calculating time on behalf of others and selecting priorities based on conjecture.

Agile methodology allows teams to measure their work in a variety of ways. It suggests that teams employ a far more obscure measure and avoid calculating effort in terms of time [22]. Common estimating techniques include t-shirt sizing, numerical scaling, and the Fibonacci series. The team’s unified understanding of the scale it uses is what matters most. As a result, everyone on the team is familiar with the scale’s values.

For the Sprint planning session, the team comes together to express how committed they are to the user stories on the backlog. The product customer needs these estimates to prioritize products effectively in the backlog and, in reaction, forecast delivery based on the team’s velocity. This requires the Product Owner to accurately assess the work’s depth. The PO is advised not to adhere to the estimations to prevent pushing a team to reduce their commitment evaluation and take on new work [18]. Additionally, steps must be taken to lower the cost of influencing a team’s self-determined outcomes. Therefore, it is advised that everyone on the team make their forecasts at the same time [20]. This method parallels a game of poker in that everyone “shows their hands” at the same time. Teams are forced to estimate differently when they have a similar understanding of their size. It requires numerous iterations of story points to add up to arrive at a final estimate that captures the perspective of a story’s complexity shared by the entire team. On the other hand, skilled teams ought to be able to get to an understanding after just a few planning poker sessions. Typically, effort estimation happens at the beginning of each new iteration during Release Preparation [27].

The User Story in Agile refers to the requirements for a feature and this is measured with size, such as below in Table 3.

Apart from estimating with these tools, there are other variables and dynamic forces that could often be volatile and unpredictable, which could impact the timeline of delivery and cost of the project [8]. Some of the factors that we have summaries from reviewing papers are as follows:

- New Team: new team members change the dynamic of the team and the responsibilities.
- New Tools: Time and effort consumed to explore new tools, databases, and programming languages; velocity will be low until the team learns to sharpen the skills.
• Beyond project task: some of the team members may have additional responsibilities out of the project scope, and also swapping them around projects will incur downtime due to the learning curve.
• Stakeholders: When information is clarified and explanation given is delayed to the team members.
• Changing management on project features: If something is new at the very last minute, introducing new team members or the current team members will affect productivity.

Table 3. Scaling of User Stories.

<table>
<thead>
<tr>
<th>Value</th>
<th>Rules</th>
</tr>
</thead>
</table>
| 5     | • Extremely long story.  
       | • Can be divided into smaller stories.  
       | • Can be shifted to a new project. |
| 4     | • Big story size.  
       | • Requires developers full-time for this story.  
       | • Split into smaller user stories. |
| 3     | • Huge Stories.  
       | • Estimated for 2 to 5 days of effort. |
| 2     | • Expected for 1 to 2 days of effort. |
| 1     | • Simple story, short, and quick to do.  
       | • The effort of fewer than 24 h. |

Therefore estimating costs and predicting completion timelines can vary in Agile as many volatile and unpredictable factors can influence them. However, if Agile projects are managed according to the proposed methodologies, a better product can be produced as customer interaction, constant check and balance with stakeholders together with an efficient team is the road to success.


The development process will be enhanced by incorporating Agile methodology into the software management project. As a result, there will be fewer bugs, quicker market release, effective stakeholder and team project communication, higher quality, and more thorough risk analysis. Although traditional software project management has its advantages, it lags behind Agile methodology in the following areas. An Agile Global Software Development encountered key challenges in software project management, including an uncertain project timeline, a lack of awareness of the project’s requirements, and a misalignment of Agile methodology with business objectives. Utilizing an Agile methodology in the project will raise the success rate, work quality, and project productivity [20].

In Figure 2, the success factor of using Agile technology in the Software Project Management Model.

There are three factors needed to boost the success rate of Agile technology in software management projects. The project management model must be combined with aspects like people, processes, and organization. This is when a new approach is created—the HYBRID Approach in Project Management.
In Figure 2, the success factor of using Agile technology in the Software Project Management Model.

### 6.1. People

The most important aspect of the pathway to success is the people factor. As early as feasible in the project’s development, stakeholders should be included in the requirement and story mapping processes. They ought to be aware of the project’s value and expected results. Building a team for a project is an important part, which consists of a project leader, skillful team members, a team owner, an expert from a related field, and a tester. Successful project delivery depends on highly skilled team members who comprehend business requirements and Agile technology [20].

### 6.2. Process

The process is a crucial step since the team leader should be aware of each team member’s assignment and its intricacy. Before allowing the stakeholders to adjust the business requirements and the team members’ tasks, the team leader must be both flexible and firm at the same time [24] to prevent any process duplication in the software management project process using Agile technologies. To maintain project performance, trust is the primary factor influencing team performance. The relationship between stakeholders and team project members will be impacted by the trust [25]. To achieve successful project performance and project effectiveness, both parties must maintain excellent communication, a profound understanding, and be free of any ulterior motives. Project planning requires meticulous planning. The early involvement of stakeholders and the project team in project planning allows for the discussion of business requirements and any risks that may arise. The necessity to document the early planning, the process throughout the project, the project’s risk, and the project’s closing after receiving feedback from the tester makes documentation an important step [20].

![Diagram of the success factor of Agile technology](image_url)
6.3. Organization

Workplace culture inside the organization could have an impact on the project. To prevent any gaps, team members require support, such as regular communication up and down the hierarchy and across organizational borders. Face-to-face contact is encouraged by Agile principles itself as much as feasible. Software project management employing Agile technology can benefit from a straightforward information systems infrastructure. Maintaining agility in a project is a difficult effort [8]; a good or bad Agile outcome will depend on the talent of the team and the stakeholders’ knowledge of Agile technology. Before beginning the project, training and learning sessions between the team members, stakeholders, and the subject-matter expert are required [20].

7. Conclusions

In this article, we analyzed the benefits and drawbacks of combining Agile and traditional software development lifecycles (project management), with the end objective of developing a hybrid strategy that will be more successful in the long run. The streamlined and easy approach to change management offered by Agile methodology, along with its greater capacity to adapt to altering business requirements, make it an ideal fit for project work. In addition, Agile cuts down on delivery timelines by dividing the project into manageable chunks. It also improves the quality of the work done by holding regular meetings at which the requirements of the job are discussed. It is necessary to find solutions to several significant problems and challenges if one wishes to prevent the failure of an Agile project. Even though Agile development lacks a cost and financial management strategy that is as effective as traditional development, the combination of the two helps makes both processes more effective. The risk connected with these kinds of technical, organizational, and technological shifts is being met with an approach that prioritizes the pursuit of Agile concepts in an aggressive manner. In the traditional, structured relational data warehouse area, Agile analytics is a well-established idea; however, before it can be used for big data analytics, it requires careful adaptation. Because the Agile methodology looks like it was developed specifically for this kind of project, it is required to understand different Agile methodologies to develop mobile applications using the Agile methodology. App development for mobile devices is a completely different animal from web development or software development for desktop PCs. We were aware that to apply Agile practices to the production of mobile applications, some adaptations of those practices would be required. The success of Agile initiatives can be attributed to many different factors. After analyzing the elements that contributed to the success of the article, it is clear that the use of Agile technology is essential for software management. Agile technology is popular in business because of its ability to adapt to changing requirements and its emphasis on working software and people over paperwork.

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Conflicts of Interest: The authors declare no conflict of interest.
Appendix A

Figure A1. Scrum Framework from https://www.visual-paradigm.com/scrum/what-are-scrum-ceremonies/ (accessed on 5 December 2022).

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