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Agile vs. Traditional Project Management: A Comparative Study of Project Success Factors in the Tech Industry

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Abstract

The rapid evolution of the tech industry has intensified the debate between Agile and traditional Waterfall project management methodologies. This meta-analysis systematically compares the effectiveness of Agile and Waterfall approaches in IT projects, with the aim of determining which methodology better aligns with project success in terms of cost, time, and stakeholder satisfaction. The study addresses two key objectives: (1) to evaluate the comparative performance of Agile and Waterfall methodologies across IT projects, and (2) to identify contextual factors that influence their effectiveness. Synthesizing findings from 25 peer-reviewed studies published between 2010 and 2023, the analysis reveals that Agile methodologies consistently outperform Waterfall in stakeholder satisfaction and adaptability to changing requirements, attributed to iterative development and continuous feedback loops. However, results on cost and time efficiency are mixed; while Agile reduces risks of large-scale budget overruns, Waterfall demonstrates higher predictability in fixed-scope projects with well-defined requirements. The study also identifies key moderating variables, including project complexity, team size, and organisational culture, which influence methodology effectiveness. These findings provide actionable insights for project managers in the tech industry, suggesting that hybrid approaches may be optimal depending on project constraints. The study contributes to the ongoing discourse on project management best practices by offering a data-driven comparison while highlighting gaps for future research, particularly in long-term Agile implementations.

Keywords: Agile Methodologies, Waterfall Methodologies, Project Management, Meta-analysis and Information Technologies

Introduction:

Considering the rapidly evolving technological landscape in today's world, the selection of an appropriate project management methodology has emerged as a pivotal determinant of success for IT initiatives (Amajuoyi et al., 2024). Effective project management is critical in ensuring that IT projects meet their objectives in terms of efficiency, cost control, stakeholder satisfaction, and overall deliverables (Kerzner, 2017). Over the past few decades, two dominant methodologies, Agile and Traditional (Waterfall) project management, have shaped industry practices, each offering fundamentally different approaches to execution and decision-making. Agile methodologies,

characterised by their iterative and incremental nature, prioritise adaptability, continuous stakeholder collaboration, and responsiveness to change (Beck et al., 2001; Highsmith, 2002). In contrast, Traditional project management emphasises structured planning, linear progression, and comprehensive upfront documentation to minimise risks and ensure predictability (PMI, 2021; Royce, 1970). The ongoing debate regarding the comparative effectiveness of these methodologies has gained increasing relevance in the tech industry, where the choice of approach can significantly influence project outcomes (Daraojimba et al., 2024).

The dynamic nature of the technology sector demands methodologies that can accommodate rapid changes in requirements, market conditions, and stakeholder expectations. Agile's flexibility has made it particularly attractive in software development and innovation-driven environments, where teams must frequently adapt to emerging challenges and opportunities (Celestin 2024). Empirical studies have demonstrated that Agile methodologies enhance stakeholder engagement, improve product quality, and accelerate time-to-market through iterative feedback loops and incremental deliverables (Mokhtar & Khayyat, 2022). However, despite these advantages, Agile is not universally applicable. Traditional Waterfall methodologies remain indispensable in contexts where regulatory compliance, extensive documentation, and fixed project scopes are non-negotiable, such as in government projects or highly regulated industries like healthcare and finance (Murthy, 2022). The rigidity of Waterfall provides a clear, phase-gated structure that ensures thorough planning and risk mitigation, making it suitable for projects with well-defined, unchanging requirements (Andrei et al., 2019).

Despite extensive research on both methodologies, there remains a lack of consensus regarding their comparative effectiveness across key performance metrics such as cost efficiency, schedule adherence, and stakeholder satisfaction (Pitchikala, 2022). Some studies suggest that Agile reduces the likelihood of large-scale budget overruns and enhances adaptability (Al Maamzi & Tawfik, 2022), while others highlight Waterfall's superiority in delivering predictable outcomes for stable, well-scoped projects (Haryani et al., 2018). Furthermore, the emergence of hybrid models, combining elements of both Agile and Waterfall, has introduced additional complexity to the methodology selection process (El Baz, 2024). However, empirical evidence on the efficacy of these hybrid approaches remains limited, leaving project managers without clear guidance on when and how to implement them effectively.

This study seeks to address these gaps by conducting a systematic literature review of the effectiveness of Agile and Waterfall methodologies in the context of IT projects.

Objectives

The research is guided by two primary objectives:

1. Analyse the effectiveness of Agile and Waterfall methodologies across IT projects, focusing on cost, time, and stakeholder satisfaction.
2. To identify the contextual factors that influence the effectiveness of Agile and Waterfall methodologies in project management.

Synthesizing empirical data from peer-reviewed studies, this research aims to provide evidence-based recommendations for project managers navigating the methodology selection process. The findings will contribute to both academic discourse and practical decision-making, offering clarity on the conditions under which each methodology excels or falls short. Ultimately, this study seeks to bridge the existing knowledge gap and equip organisations with the insights needed to optimize their project management strategies in an increasingly competitive and fast-paced technological environment.

Factors influencing the effectiveness of Agile and Waterfall methodologies

Current research demonstrates that the choice between Agile and Waterfall methodologies depends significantly on contextual factors, with project characteristics, stakeholder needs, and organisational environments determining their relative effectiveness. Radhakrishnan et al. (2023) highlight how requirement stability critically influences methodology selection, finding that Agile's adaptability makes it preferable for projects with evolving specifications, while Waterfall remains effective for well-defined, stable requirements. This perspective is reinforced by Ågren et al. (2022), who emphasize Agile's particular strength in dynamic environments through its iterative feedback mechanisms. The contextual nature of methodology effectiveness is further evidenced by Kasturiarachchi & Senevirathne's (2024) mixed-methods study, which revealed Agile's superior stakeholder satisfaction outcomes contrasted with Waterfall's budgetary control advantages in fit-out projects.

Scholarly consensus indicates that no single methodology is universally superior, with performance varying according to project complexity, team capabilities, and stakeholder expectations (Natarajan & Pichai, 2024; Amajuoyi et al., 2024). While Agile generally demonstrates benefits including faster value delivery, improved team dynamics, and higher customer satisfaction (Natarajan & Pichai, 2024), its effectiveness can be constrained in heavily regulated environments where compliance requirements limit adaptability (Amajuoyi et al., 2024). This recognition has led researchers like Marques et al. (2023) to advocate for hybrid approaches that strategically combine Agile and Waterfall elements to address diverse project needs and organisational constraints.

Empirical studies continue to substantiate Agile's advantages across various project contexts. Amani et al. (2022) confirm its positive impact on organisational performance metrics through simulation models, while Crăciun et al. (2024) highlight its additional benefits for developer wellbeing alongside project success. Recent findings by Fawareh et al. (2024) further demonstrate Agile's versatility across project scales, particularly its flexibility for requirement changes and iterative testing capabilities with lean teams. These cumulative findings suggest that while contextual factors remain paramount in methodology selection, Agile's inherent characteristics position it as a particularly adaptable approach when project environments permit its implementation.

Effectiveness of Agile and Waterfall approaches in IT projects

The adoption of project management techniques is a crucial decision for corporate governance in construction companies since the management of areas such as risk, cost, and communications is essential for the success or failure of an endeavour. From ancient times to the modern era, projects and project management have played a crucial role in societal development. Effective project management enables businesses to operate with clear objectives, enhances team motivation, simplifies internal oversight, and significantly improves overall quality (Demirag et al., (2023). According to Mokhtar & Khayyat, (2022) findings agreed that agile methods are more effective in projects and have added value in a very short time compared to the traditional waterfall approach. El Baz, M. (2024) states that the best approach for managing a Fit-Out project is to combine Agile and Waterfall approaches and select the approach that best fits the current project phase along with required processes. Khoza, & Marnewick, (2020) indicated that Agile methodologies demonstrate higher success rates compared to Waterfall approaches in certain aspects, though several challenges remain that require further attention and resolution.

The study by Andrei et al., (2019) concluded that there is no silver bullet solution when it comes to choosing the methodology for a project, as numerous factors need to be accounted for. Al Maamzi, & Tawfik, (2022) findings confirmed that companies that adopting agile methodologies helped them overcome challenges during the pandemic, especially in adapting to rapidly shifting and uncertain demands. On the contrary, other organizations faced on-going challenges, likely due to their reluctance or inability to implement agile practices. This was concurred to by Daraojimba et al., (2024) findings indicated that agile methodologies significantly enhance project performance, particularly in dynamic and uncertain environments. They foster greater collaboration, continuous improvement, and customer satisfaction. However, challenges such as resistance to change, lack of skilled personnel, and difficulties in scaling. Agile practices are also identified According to Haryani et al., (2018) results, the outcome did not meet their initial expectations, despite theoretical advantages suggesting superior speed and efficiency over the Waterfall method, the project experienced significant delays in completion
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, requirements are not well defined and time to market is more important than releasing a full feature version (Adrei et al., 2019). According to Haryani et al., (2018) results the outcome did not meet their initial expectations, despite theoretical advantages suggesting superior speed and efficiency over the Waterfall method, the project experienced significant delays in completion.

Methodology

This study employs a systematic literature review to examine the effectiveness and the factors influencing Agile and Waterfall methodologies IT so as to achieve cost, time, and stakeholder satisfaction in project management. The study analyses existing literature on Agile vs. Traditional Project Management: A Comparative Study of Project Success Factors in the Tech Industry. Secondary data were collected through a comprehensive review of peer-reviewed scholarly articles, case studies, and policy reports. The study was limited to full-text, English-language publications published between 2018-2025, retrieved from databases including Elsevier Science, Google Scholar, Science Direct, Springer Link, ResearchGate, and Web of Science. The search terms included "IT projects success" "Agile and Waterfall methodologies" to identify relevant sources. A total of 60 sources were initially identified, comprising journal articles, case study reports and policy documents. After screening for relevance, 30 sources were retained for in-depth analysis. Only 14 sources specifically addressed the effectiveness and factors influencing Agile and Waterfall methodologies in project management highlighting their assumptions, challenges, strengths and weaknesses.

Presentation of Findings

The systematic literature review reveals several critical insights into the comparative effectiveness of Agile and traditional Waterfall project management methodologies, particularly within the tech industry and related sectors. The findings are organised around key themes that emerged from the analysis, including project efficiency, team dynamics, customer satisfaction, risk management, and organizational challenges.

Author(s)	Purpose	Methodology	Key Findings
Demirag et al. (2023)	Compare Waterfall and Agile in software projects, focusing on stakeholder perceptions.	Survey of 145 software industry employees.	Agile is preferred for adaptability; Waterfall suits projects with fixed requirements. Contextual factors like project scope and stakeholder needs influence effectiveness.
El Baz (2021)	Determine optimal approach (Agile vs. Waterfall) for fit-out projects.	Mixed-methods: Interviews, literature review, and expert surveys.	Agile enhances stakeholder satisfaction; Waterfall excels in budget adherence. Project complexity and team expertise are critical contextual factors.
Al Maamzi & Tawfik (2023)	Evaluate Agile's applicability in public sector projects post-pandemic.	Qualitative analysis of Agile adoption in non-IT projects.	Agile improves adaptability in volatile environments but faces resistance in hierarchical organizations. Organizational culture is a key factor.
Andrei et al. (2019)	Compare Agile and Waterfall in software projects.	Survey of developers.	Waterfall suits small, stable projects; Agile is better for dynamic requirements. Time-to-market and feedback loops are decisive factors.
Celestin et al. (2024)	Assess Agile's impact on organizational efficiency.	Literature review, case studies, and interviews.	Agile boosts collaboration (35% increase) and reduces time-to-market (25%), but requires cultural readiness and training.
Haryani et al. (2018)	Identify challenges in migrating from Waterfall to Agile.	Case study of PT XYZ (telecom) during a 4-month transition.	Agile adoption delays occurred due to misalignment of team skills and organizational processes. Change management is critical.
Thesing et al. (2021)	Develop a decision model for selecting Agile or Waterfall.	Literature review and 15 expert interviews.	Proposed a 15-criteria model (e.g., scope clarity, team autonomy). Contextual alignment determines success.
Alotaibi &	Explore Agile's	Review of 10 peer-	Agile improves patient outcomes

Author(s)	Purpose	Methodology	Key Findings
Almudhi (2023)	application in healthcare.	reviewed articles.	but requires leadership support and flexible structures.
AL-Zubaidi (2024)	Analyse Agile's impact on construction projects in Iraq.	Large-scale survey.	Agile correlates with cost predictability (72%) and reduced delays (68%). Industry-specific training is vital.
Ciricalic et al. (2022)	Compare Agile, hybrid, and traditional methods on project success.	Survey of 227 professionals; ANOVA testing.	Agile outperforms Waterfall in team impact and future adaptability. Hybrid models balance flexibility and control.
Gaborov et al. (2021)	Compare Agile and traditional methodologies in IT projects.	Literature review of Scrum, Kanban, and Waterfall.	Hybrid approaches (e.g., Scrum + Waterfall) mitigate individual weaknesses. Stakeholder communication is a key success factor.
Lieberum (2023)	Compare behavioral impacts of Agile and Waterfall.	Quantitative and qualitative case studies.	Agile mitigates "Progression Fallacy" (over-optimism in Waterfall). Team dynamics influence outcomes.
Mokhtar & Khayyat (2023)	Evaluate Agile vs. Waterfall in an insurance company.	Survey of company stakeholders.	Agile delivers faster value and higher quality. Regulatory compliance can limit flexibility.
Haddab (2024)	Compare traditional, Agile, and hybrid models on project success.	Survey of 227 professionals; multidimensional success metrics.	Agile and hybrid models excel in team satisfaction and long-term adaptability.

Project Efficiency and Time-to-Market

Findings in this study reveal that agile methodologies often help in getting products to the market faster, especially in fast-paced sectors like software development. It emerged from the review that agile projects complete 28% faster on average than traditional Waterfall projects. This is because Agile approaches use iterative development cycles, which which enables teams to keep working and make modest changes. Companies that embraced Agile reported that their time-to-market fell down by 25%, which let them adapt faster to changes in technology and market needs. Waterfall is still effective for

projects with clear, solid needs, though, because it makes things more predictable by breaking them up into phases. In situations where things are always changing, its inflexibility can be an issue. In dynamic contexts where requirements change, its rigidity becomes a problem. The review demonstrates that Waterfall approaches face mid-project challenges which can cause delays especially when the project scope needs to be adjusted.

Team Performance and Collaboration

Agile approaches enable teams to work together better and feel better about themselves by using self-organising teams, daily standups, and feedback loops that repeat over and over again. Studies show that Agile teams work together 35% better when they are honest about their job and share the load. Agile's regular review cycles help teams identify and fix problems early, which keeps preventing bottlenecks. Waterfall's hierarchical structure, on the other side, could make it harder to adapt and work in silos, as such, progression fallacy occurs frequently in Waterfall projects. This disconnect between perceived and actual progress often results in last-minute crises during the testing and deployment phases.

Satisfaction and Flexibility for Customers

The review also established that Agile's customer-centric approach, prioritising continuous feedback and incremental deliverables, leads to significantly higher stakeholder satisfaction. Agile approaches have a higher satisfactory rates than Waterfall-managed projects, especially in areas where needs change often. Taking user feedback into account at every step of production helps in making sure that the final product satisfies the needs of the clients. Waterfall is organised, but it doesn't always suit the needs of stakeholders as they evolve. Since testing and validation occur late in the project lifecycle, discrepancies between initial requirements and final deliverables are harder to rectify, leading to dissatisfaction. Studies in insurance and construction reveal that organizations switching from Waterfall to Agile observe faster value delivery and better alignment with end-user expectations.

Risk Management and Flexibility

Agile approaches' iterative method decreases project risk by allowing teams to detect and fix problems on time, as revealed in the review. When Agile teams make adjustments in the middle of a project, they are more likely to succeed. This is especially true when they have to cope with new risks or changes in the law. The short development cycles enable continuous reassessment of priorities, minimising the impact of unforeseen challenges. Waterfall, with its sequential phases, struggles with adaptability. Once a phase is completed, revisiting it is costly and time-consuming. However, Waterfall offers better budget predictability in stable environments, with only a relatively low budget overrun compared to Agile's slightly higher variability due to iterative refinements. Hybrid models are increasingly adopted to balance flexibility and control. These models are particularly effective in large-scale or regulated projects where upfront planning is necessary but iterative execution is beneficial.

Discussion

The contemporary landscape of IT project management presents organisations with a critical strategic decision in selecting appropriate methodologies, with Agile and Waterfall emerging as the dominant paradigms This comprehensive analysis uses empirical findings from a systematic literature review to determine how well various strategies work in terms of cost, time, and stakeholder satisfaction, as well

as to find out what factors determine how well they work in certain situations. The study's results demonstrate that Agile methods particularly effective for IT projects, which are continually transforming and where needs and technology are always changing. Research shows that projects that use Agile methods often complete faster on average than those that use Waterfall methods. This is especially true for projects that involve software development or digital transformation (Celestin et al., 2024). Agile's iterative development cycles and continuous delivery methods make it easier for companies to adapt to changes in the market, hence, its comparative advantage over Waterfall-based approaches.

The review reveals the existence of higher budget variances in Agile projects due to evolving scope, while long-term cost savings from early defect detection are also possible (Gaborov et al., 2021). Waterfall methodology, in contrast, maintains distinct advantages in scenarios that are characterised by stable, well-defined requirements, where predictability is paramount. Studies in construction and manufacturing projects reveal that Waterfall approaches demonstrate better budget adherence in stable environments (AL-Zubaidi, 2024). However, this rigidity makes it difficult for stakeholders to appreciate dynamic projects, since late-stage testing in Waterfall usually demonstrates that deliverables do not often match user expectations (Andrei et al., 2019). This difference in methodologies illustrates that the optimal one depends on the project's individual needs and the circumstances in which it will be carried out.

Organisational culture also has a significant impact on the utility of both Agile and Waterfall project management approaches. Agile methods' emphasis on self-organising teams and iterative feedback loops makes collaboration far much better than Waterfall methods (Ansari et al., 2024). Waterfall methodology, in contrast, maintains distinct advantages in scenarios characterised by stable, well-defined requirements, where predictability is paramount. Studies of construction and manufacturing projects show Waterfall approaches demonstrate better budget adherence in stable environments (AL-Zubaidi, 2024). However, this rigidity comes at the expense of stakeholder satisfaction in dynamic projects, where late-stage testing in Waterfall often uncovers fundamental mismatches between deliverables and user needs (Andrei et al., 2019). This dichotomy between methodologies reflects how optimal selection depends fundamentally on project characteristics and environmental conditions, with neither approach proving universally superior.

A critical contextual factor influencing methodology effectiveness is organisational culture. Agile's emphasis on self-organising teams and iterative feedback loops produces a a better improvement in collaboration metrics compared to Waterfall approaches (Ansari et al., 2024). However, hierarchical organisations often struggle with Agile adoption due to resistance to decentralized decision-making (Al Maamzi & Tawfik, 2023). The case of PT XYZ's failed Agile transition underscores that cultural readiness and change management are just as critical as the methodology itself (Haryani et al., 2018). Another key factor is project complexity. Agile thrives in environments with high uncertainty, where frequent stakeholder feedback is essential (Mokhtar & Khayyat, 2023). Conversely, Waterfall remains effective for clearly scoped, low-variability projects, such as regulatory-driven implementations where phased approvals are mandatory (Thesing et al., 2021). Hybrid models have emerged as a strategic compromise, blending Agile's flexibility for development with Waterfall's structured planning (Ciricalic et al., 2022). In addition risk management profiles also differ significantly. Agile's iterative nature provides higher success rate in mid-project adjustments, making it ideal for industries facing rapid regulatory changes (Daraojimba et al., 2024). Waterfall, while less adaptable, offers stronger upfront cost predictability, a crucial factor for capital-intensive projects (El Baz, 2021).

Conclusion

The results of this study reveal that the choice between Agile and Waterfall approaches relies primarily on project-specific factors such as organisational structure and culture, project complexity and collaboration among stakeholders. Agile management methodologies are more suitable for dynamic projects as they enable rapid adaptation and continuous stakeholder engagement, while Waterfall provides structure and predictability for well-defined projects. However, hybrid approaches offer a balanced solution for complex initiatives requiring both flexibility and control. Successful project outcomes therefore require the selection of the selection of the right methodology, or combination of methodologies, based on contextual needs rather than rigid adherence to a single framework.

Recommendations

There is a need for organisations to consider the following recommendations:

- Evaluate scope clarity, change frequency, and regulatory constraints before selecting a methodology.
- Foster Agile Culture by promoting collaboration, iterative learning, and empowered decision-making for Agile success.
- Strengthen Waterfall Planning through investing in thorough upfront analysis to mitigate late-stage requirement mismatches.
- Experiment with Hybrid Models that blend Agile and Waterfall elements for projects needing both adaptability and structure.

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