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IT PROJECT MANAGEMENT FRAMEWORKS: EVALUATING BEST PRACTICES AND METHODOLOGIES FOR SUCCESSFUL IT PROJECT MANAGEMENT

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ABSTRACT

This study provides a systematic review of IT project management frameworks, examining the effectiveness, adaptability, and risk management strategies of methodologies such as Agile, Waterfall, PRINCE2, Scrum, and hybrid approaches. A total of 133 peer-reviewed articles were analyzed to gain insights into how these frameworks are being applied across various industries and project environments. The findings reveal that hybrid models, which combine the structured governance of traditional methodologies like Waterfall with the iterative flexibility of Agile, are becoming increasingly popular, especially in industries requiring both regulatory compliance and adaptability to changing requirements. Agile frameworks were shown to significantly improve project delivery speed, stakeholder satisfaction, and risk mitigation through continuous iterations and feedback loops, while traditional methodologies like Waterfall remain essential in sectors with strict documentation and control requirements. The review also highlights the critical role of risk management across all frameworks, with hybrid models offering the most comprehensive approach by integrating early-stage planning with ongoing risk assessment. Despite the success of these frameworks in IT-related industries, a notable gap was identified in their application to non-IT sectors, suggesting a need for further research to explore their broader applicability. This review underscores the continued relevance of traditional, Agile, and hybrid project management frameworks, while also pointing to future opportunities for expanding their use beyond IT.

KEYWORDS

IT Project Management; Agile Methodology; Waterfall Framework; Stakeholder Involvement; Risk Management

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1 Introduction

IT project management has become a cornerstone in ensuring the successful implementation of technology-driven initiatives across industries (Crawford & Bryce, 2003). The rapid evolution of technology and increasing complexity of IT projects have necessitated the adoption of structured project management methodologies (Ihuah et al., 2014). In the past, traditional approaches like the Waterfall model were widely used, relying on a sequential design process that emphasized completing one phase before moving to the next. This approach worked well for predictable projects but became less effective for projects with evolving requirements. As the landscape of IT projects shifted, newer, more adaptive methodologies, such as Agile and Scrum, emerged to address the challenges of flexibility and speed in project execution (Brechner, 2015). These frameworks have garnered attention for their iterative approaches, enabling teams to respond dynamically to changes and feedback throughout the project lifecycle (Boehm, 2002). Understanding the evolution of IT project management frameworks and the impact of different methodologies is crucial for IT leaders who must navigate the complexities of modern technological implementations.

The historical context of IT project management can be traced back to the mid-20th century, when large-scale projects like the Apollo space program highlighted the need for structured management practices (Alqudah & Razali, 2017). The Waterfall model, developed by Winston Royce in 1970, became the dominant framework due to its linear and systematic approach (Beck et al., 2001). Waterfall's structure allows for meticulous planning, making it suitable for projects with well-defined goals and minimal expected changes. However, as software development evolved and became more iterative, with continuous changes in requirements, the limitations of Waterfall became evident. (Brechner, 2015) introduction of the Spiral model, which combined iterative development with risk management, laid the foundation for more flexible frameworks that could adapt to uncertainty. These shifts in methodology reflect the growing realization that many IT projects require a balance between structure and adaptability.

The rise of Agile methodologies marked a significant turning point in IT project management, responding to the limitations of traditional models. Agile, formalized in the Agile Manifesto in 2001, emphasized collaboration, customer feedback, and flexibility over rigid planning (Thesing et al., 2021). Studies by Kannan et al. (2014) on Ciric et al. (2019) on Agile highlighted the benefits of iterative cycles that allow for constant revision and refinement based on stakeholder input. Agile has become particularly popular in industries where innovation is rapid, and requirements are not fully understood at the project's outset. This paradigm shift has been supported by research showing that Agile methodologies lead to faster time-to-market and higher customer satisfaction in dynamic environments. However, Agile's focus on flexibility can be a double-edged sword, with some projects suffering from scope creep or lack of direction when not properly managed (Boehm & Turner, 2003).

Hybrid frameworks have also emerged as companies seek to leverage the strengths of both traditional and Agile methodologies. PRINCE2, a structured yet flexible project management methodology, integrates well with Agile, offering a governance structure while allowing for iterative development (Serrador & Pinto, 2015). Research by Wysocki (2019) found that blending methodologies can be beneficial for organizations that need the discipline of traditional methods but the adaptability of Agile practices. Furthermore, studies have shown that combining elements of Waterfall and Agile, known as the "Water-Scrum-Fall" approach, allows organizations to better manage project risks while maintaining flexibility (Hamid et al., 2015). These hybrid approaches reflect the evolution of project management methodologies in response to the diverse needs of modern IT environments. Despite the array of methodologies available, the selection of an appropriate IT project management framework remains a critical challenge for project managers. The choice of methodology depends not only on the nature of the project but also on organizational culture, team structure, and stakeholder expectations. According to Boehm (2002), organizations that can tailor their project management methodologies to the specific needs of their projects tend to experience higher success rates. This tailoring involves understanding the key strengths and limitations of each framework. For example, while

Agile may be highly effective in projects requiring rapid iteration, Waterfall might be preferable in projects where clarity of scope is paramount from the start (Alqudah & Razali, 2017). Ultimately, the evolution of IT project management methodologies illustrates the industry's ongoing effort to balance flexibility and control to achieve optimal outcomes. The aim of this study is to evaluate the best practices and methodologies in IT project management frameworks to determine how they contribute to successful project outcomes. By analyzing widely-used frameworks such as Agile, Waterfall, Scrum, and PRINCE2, the study aims to identify their strengths and limitations in different project environments. It also seeks to explore the evolution of these methodologies and how they have adapted to meet the growing complexity and dynamism of modern IT projects. Additionally, this research aims to provide insights into selecting the most appropriate methodologies based on factors such as project size, complexity, and organizational culture, offering a comprehensive guide for IT professionals seeking to optimize project performance.

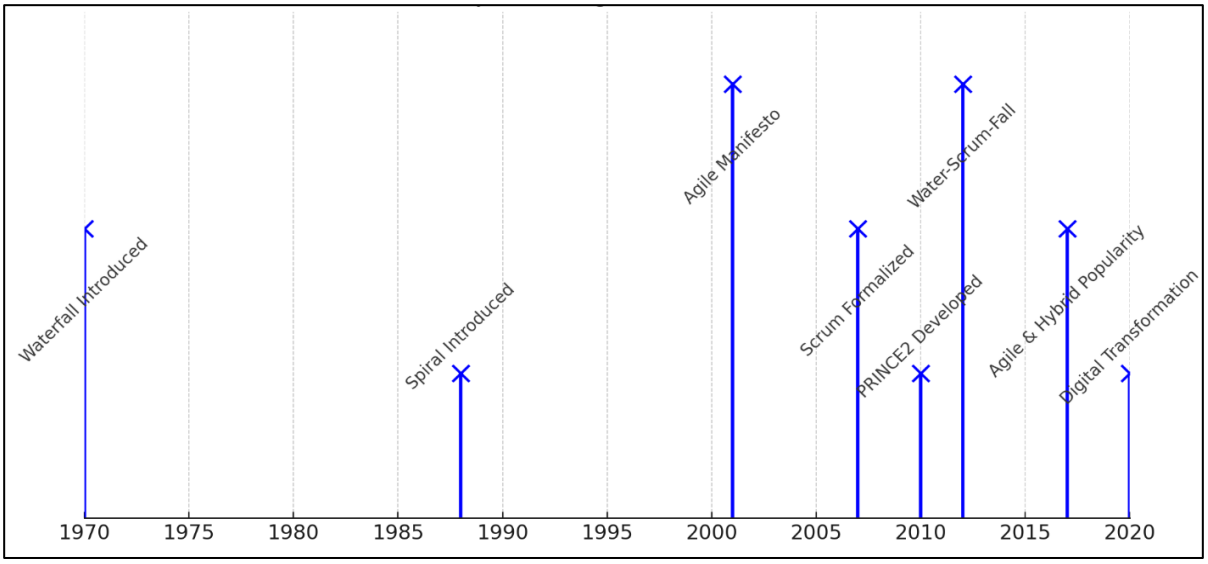
2 Literature Review

The field of IT project management has evolved significantly over the past few decades, with various methodologies and frameworks emerging to address the unique challenges of technology-driven projects. This section explores the existing body of research on IT project management frameworks, focusing on key methodologies such as Waterfall, Agile, Scrum, and PRINCE2. It synthesizes findings from academic studies and industry reports to highlight the strengths, limitations, and contextual applicability of each approach. By examining the evolution of these methodologies, this review provides a comprehensive understanding of how they contribute to project success and guides the selection of appropriate frameworks based on project characteristics.

2.1 Evolution of IT Project Management Frameworks

The historical development of IT project management frameworks has been marked by the emergence of structured methodologies to tackle the increasing complexity of technology-based projects. The earliest recognized model, the Waterfall methodology, was introduced by Winston Royce in the 1970s, proposing a linear and sequential approach that emphasized thorough planning and step-by-step execution (Pilli-Sihvola et al., 2018). Waterfall became the standard for project management due to its clear phases and systematic progression from requirements analysis to testing and deployment (Brechner, 2015). This model suited projects with stable requirements but often faced criticism for its rigidity and inability to accommodate changes mid-project. Research by Ciric et al. (2019) addressed this issue by introducing the Spiral model, which incorporated iterative risk assessment and revisions, thus laying the foundation for more adaptive project management approaches.

Figure 1: Timeline of IT Project Management Framework Evolution



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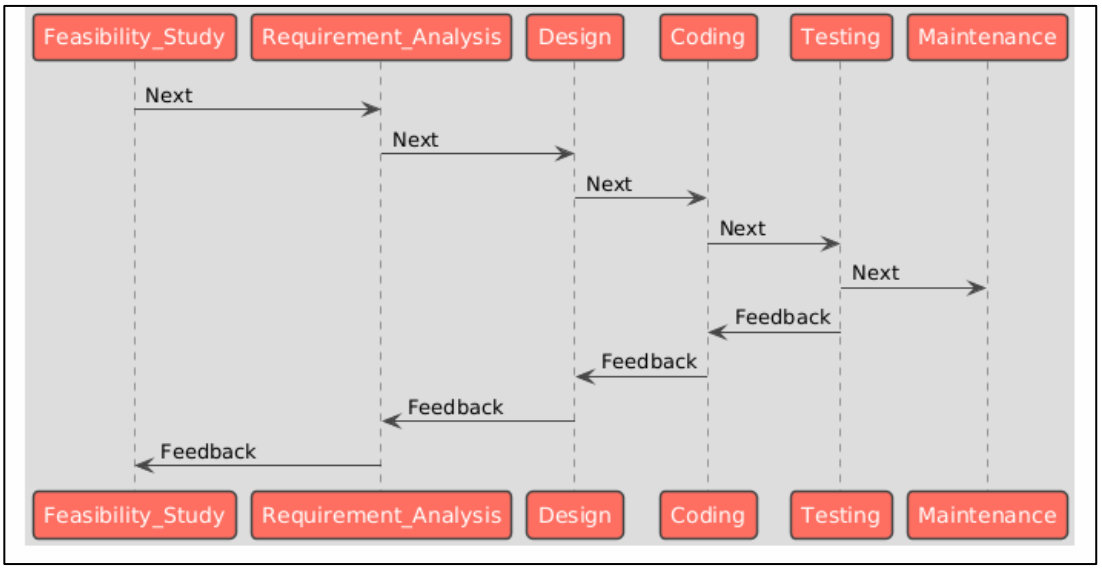
In response to the limitations of traditional models, new frameworks emerged to meet the dynamic needs of software and IT projects. The Agile Manifesto, published in 2001 by Beck et al., was a pivotal moment that promoted a fundamental shift from rigid structures to more collaborative, iterative processes (Myers et al., 2018). Agile methodologies, including Scrum and Extreme Programming (XP), focus on adaptive planning, evolutionary development, and delivering functional products in small, iterative cycles (Ding & Xu, 2014). Agile's emphasis on flexibility, customer involvement, and incremental progress has made it highly popular in industries facing rapidly changing requirements, with research showing improved project outcomes, including faster delivery and higher customer satisfaction (Ciric et al., 2019). The flexibility of Agile methodologies represents a departure from the traditional, one-size-fits-all approach of earlier frameworks.

The rise of Agile did not signify the abandonment of structured methodologies altogether; rather, it paved the way for hybrid approaches that combine the strengths of traditional and Agile frameworks. PRINCE2, initially developed by the UK government, offers a structured governance framework while allowing adaptability within project stages (Al-Sanad, 2015). The Water-Scrum-Fall model is an example of a hybrid approach that integrates Waterfall's structure with Scrum's iterative cycles, balancing control and flexibility (Boehm & Turner, 2003). Studies indicate that hybrid methodologies can be effective in organizations where certain aspects of projects need stringent governance while others require iterative adaptability (Al-Sanad, 2015). This evolving landscape reflects the recognition that no single methodology fits all projects, and a tailored approach can lead to greater project success. The evolution of IT project management frameworks continues as industries and project complexities evolve. Today's methodologies not only emphasize technical development but also integrate best practices in stakeholder communication, risk management, and quality control. Research by Project Management Institute (PMI) indicates that organizations increasingly adopt Agile and hybrid models to accommodate the uncertainties inherent in IT projects, leading to improved efficiency and project outcomes (Oliveira, 2018). Furthermore, the emergence of new technologies and global trends, such as digital transformation and remote work, continues to influence the development of project management methodologies. These changes indicate that the field will likely see further innovations to address emerging project challenges and enhance adaptability (Sacks et al., 2018).

2.2 The Waterfall Model

The Waterfall model, introduced by Winston Royce in 1970, is one of the earliest structured approaches to project management in software development. It follows a linear, sequential design where each phase of the project, such as requirements gathering, design,

Figure 2: The iterative Waterfall model



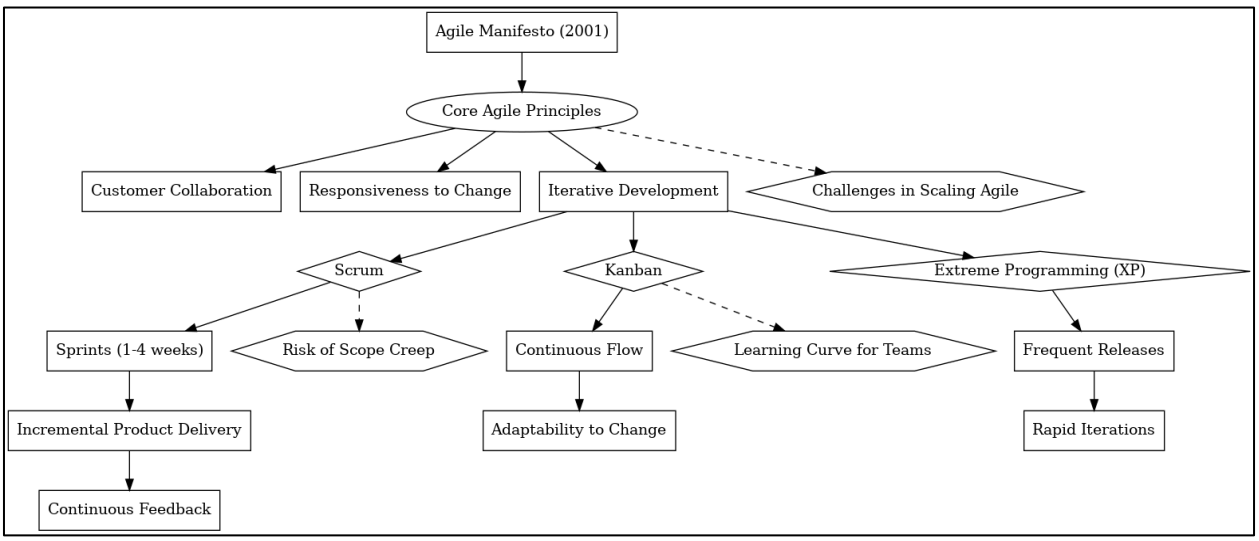
implementation, testing, and maintenance, must be completed before the next begins (de Azevedo et al., 2019). This phase-based approach provides a clear path for project progression and ensures that each phase is thoroughly documented before moving to the next. Studies have praised this model for its ability to handle well-defined projects with fixed requirements, as the upfront planning minimizes uncertainties later in the project lifecycle (Oliveira, 2018). Moreover, the Waterfall model's inherent structure supports large, stable projects, especially in industries like construction and manufacturing, where changes are less frequent once the design has been established (Laasch, 2018). However, the rigidity of the Waterfall model presents significant challenges in adaptive or dynamic project environments. Because it relies heavily on completing one phase before moving to the next, changes introduced after the project has moved forward are difficult to accommodate, leading to potential delays and cost overruns (Pan & Zhang, 2020b). Research has shown that in fast-moving industries such as software development, where client needs and technology often evolve rapidly, the Waterfall approach struggles to keep pace (Verdolini et al., 2018). The model's inflexibility becomes particularly problematic when unforeseen changes or additional requirements arise mid-project, forcing teams to revisit earlier stages, which can disrupt timelines and increase costs (de Azevedo et al., 2019).

The strengths of the Waterfall model lie in its structured nature, making it suitable for projects where all requirements are clear from the beginning and unlikely to change. For instance, in environments where regulatory compliance or safety is critical, such as aerospace or defense, the Waterfall model's linear approach ensures that each phase is meticulously completed before advancing (McDowell, 2018). In these contexts, the model's emphasis on documentation and clear milestones provides a level of control and predictability that is highly valued (Pan & Zhang, 2020a). Moreover, its phase-based design helps reduce project risk in industries where comprehensive testing and approval at each stage are necessary before proceeding further. Despite its strengths, the limitations of the Waterfall model in rapidly changing environments have led to its decline in popularity in recent decades, particularly in software development (Günther & van der Aalst, 2007). The rise of iterative methodologies, such as Agile, was driven by the need for frameworks that could handle frequent changes and adapt to evolving client requirements (Verdolini et al., 2018). Studies have suggested that while Waterfall is effective in specific, stable environments, it lacks the flexibility needed for projects where requirements are subject to change throughout the project lifecycle (Oliveira, 2018). Consequently, many organizations now prefer more flexible methodologies that allow iterative development, such as Scrum and Agile, to better accommodate dynamic project needs (Pan & Zhang, 2020a).

2.3 Agile Methodologies

Agile methodologies emerged in response to the

Figure 3: Diagram of Agile Methodology



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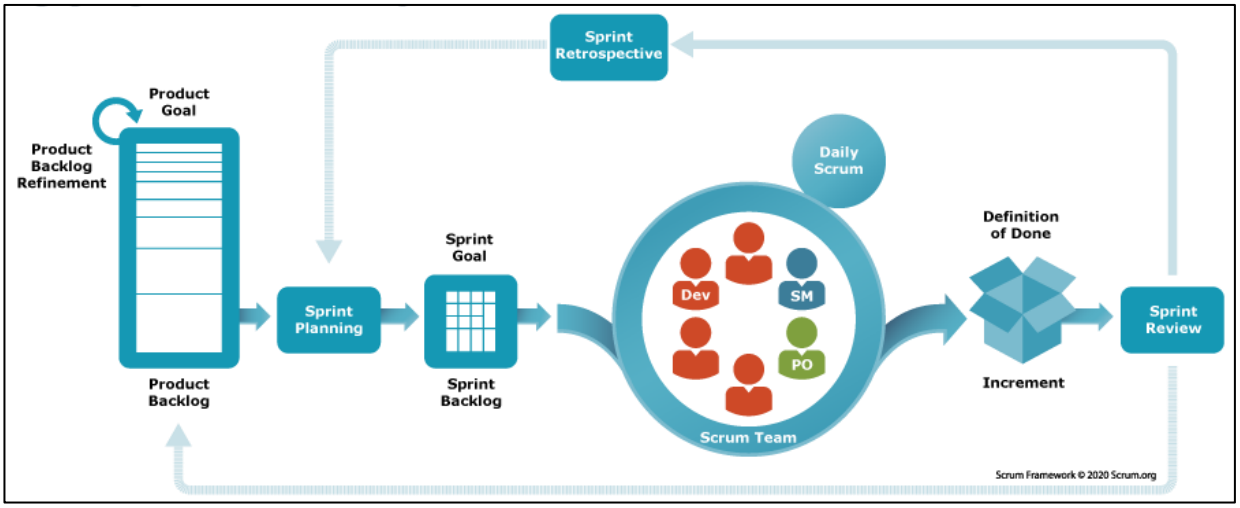
limitations of traditional project management approaches like the Waterfall model, particularly in software development. The origins of Agile can be traced back to the 1990s, but it was formally defined with the publication of the *Agile Manifesto* in 2001 by a group of 17 software developers, including Kent Beck and Martin Fowler. The manifesto outlined key principles emphasizing customer collaboration, responsiveness to change, and iterative progress through small, frequent releases (Labuschagne et al., 2005). Agile was developed as an antidote to the rigid, phase-based processes of traditional methodologies, promoting continuous customer feedback and adaptive planning. As a result, Agile methodologies, including Scrum, Kanban, and Extreme Programming (XP), have gained prominence for their ability to deliver value incrementally and respond swiftly to changing requirements (McDowell, 2018). At the core of Agile is a focus on flexibility, collaboration, and iterative cycles. Agile emphasizes empowering cross-functional teams to collaborate closely with stakeholders, ensuring that the project continuously evolves to meet user needs (Laasch, 2018). Unlike the linear structure of Waterfall, Agile breaks projects into sprints or iterations, which typically last between one to four weeks. Each sprint culminates in the delivery of a functional product increment that can be reviewed and adjusted based on feedback (Golparvar-Fard et al., 2009). Research shows that this iterative approach not only accelerates time-to-market but also enhances customer satisfaction, as teams can quickly adapt to new information or changes in project scope (Pan & Zhang, 2021). Agile's ability to foster continuous improvement makes it especially suited for dynamic and complex IT environments where requirements are often unpredictable (Pulaski & Horman, 2005).

Despite its many advantages, Agile also presents challenges in certain IT environments. For example, while Agile's flexibility is a strength in fast-moving industries, it can lead to scope creep if not properly managed (Zhao & Chen, 2018). Research suggests that Agile works best when teams have a high level of experience and autonomy, as the methodology demands frequent communication, decision-making, and adaptability (Li et al., 2011). In large organizations or projects with strict regulatory requirements, Agile may face difficulties in integrating with traditional governance and compliance structures (Lam et al., 2017). Furthermore, Agile's emphasis on iterative cycles can be challenging in industries where detailed documentation or long-term planning is essential. Studies have also shown that transitioning from Waterfall to Agile may involve a steep learning curve, as organizational cultures and processes must shift to support Agile's collaborative, fast-paced model (Mavi & Standing, 2018). Despite these challenges, Agile has demonstrated considerable success in IT environments that require rapid innovation and responsiveness to change. (Cheema & Shahid, 2005) highlight Agile's transformative impact in sectors such as software development, where the need for speed and flexibility has made Agile the preferred methodology for many organizations. Other studies suggest that Agile's principles can be adapted to non-IT environments,

Figure 4: Scrum Framework



including marketing, product development, and even healthcare (Baumgartner & Ebner, 2010). The adaptability of Agile methodologies across various industries suggests that their core principles—collaboration, flexibility, and iterative development—are universally applicable, albeit requiring tailored implementation strategies depending on the organizational context (Banihashemi et al., 2017). As Agile continues to evolve, hybrid models that integrate Agile with traditional methodologies, such as PRINCE2 Agile, have emerged to address the challenges of scaling Agile in large, complex organizations (Maqbool & Sudong, 2018).

2.4 Scrum: A Framework for Agile Project Management

Scrum is one of the most widely adopted frameworks within Agile project management, designed to facilitate flexibility, collaboration, and incremental progress in complex projects. Introduced by Ken Schwaber and Jeff Sutherland in the early 1990s and formalized in *The Scrum Guide* (Pan et al., 2020), Scrum operates through clearly defined roles, ceremonies, and artifacts. Key roles include the Scrum Master, who facilitates the process and removes obstacles; the Product Owner, responsible for prioritizing the backlog and ensuring that the team delivers value; and the Development Team, which self-organizes to complete tasks within sprints (Boonstra & Reezigt, 2019). This framework's simplicity in roles and structure allows for transparent communication and promotes accountability, making it a powerful tool for managing IT projects with rapidly changing requirements (Toor & Ogunlana, 2008). Scrum is particularly effective in managing short, iterative work cycles known as sprints, which typically last between one to four weeks. During each sprint, the Development Team focuses on completing specific tasks from the product backlog, a prioritized list managed by the Product Owner (Ahadzie et al., 2008). At the end of each sprint, a potentially shippable product increment is delivered, which allows for continuous feedback from stakeholders and subsequent adjustments (Iacono, 2013). This iterative approach to project management helps teams remain flexible and responsive to changes, making Scrum especially valuable in environments where client requirements evolve frequently (Cheema & Shahid, 2005). Empirical studies indicate that Scrum's emphasis on short delivery cycles and regular feedback increases team productivity and reduces the likelihood of significant project delays (Ahadzie et al., 2008).

The success of Scrum in software development projects has been widely documented. Research by (Maqbool & Sudong, 2018) found that projects managed using Scrum generally have higher success rates, largely due to the framework's adaptability and focus on collaboration. Agile teams using Scrum have been shown to deliver products more quickly and with higher customer satisfaction compared to those using traditional project management methods (Iacono, 2013). Additionally, Scrum's approach of iterative development reduces risks associated with large-scale software projects by providing opportunities for regular course corrections (White & Fortune, 2002). Zhao and Chen (2018) emphasizes that the transparency and accountability embedded in the Scrum process make it particularly effective for cross-functional teams, which are common in software development. Despite its strengths, Scrum is not without its challenges. For Scrum to be successful, the organization must foster a culture that supports self-organization and empowerment of teams (Li et al., 2011). Studies show that Scrum can be difficult to implement in large organizations or environments that are heavily hierarchical, as the framework relies on decentralized decision-making and strong collaboration among team members (Banihashemi et al., 2017). Furthermore, while Scrum emphasizes flexibility, it requires a high level of discipline to ensure that teams remain focused and complete tasks within the specified timeframes (Yong & Mustaffa, 2013). Transitioning to Scrum can also be difficult for teams accustomed to traditional methodologies, as they must adapt to new roles and processes, which may lead to resistance or confusion (Baumgartner & Ebner, 2010). Nonetheless, when implemented effectively, Scrum remains one of the most successful frameworks for Agile project management, particularly in software development.

2.5 PRINCE2: A Structured and Flexible Approach

PRINCE2 (Projects IN Controlled Environments), developed by the UK government in the 1980s and widely adopted internationally, is a structured project management methodology that combines governance and flexibility to support the delivery of successful projects across various industries. PRINCE2 emphasizes a process-driven approach, with defined stages that include initiating, directing, managing, and

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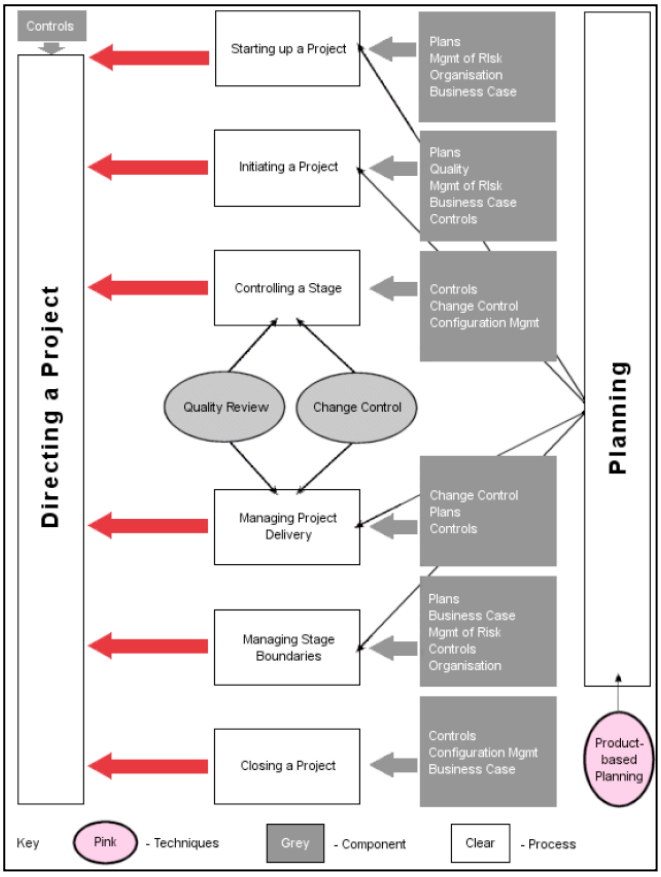
closing projects, while also offering the flexibility to adapt to the specific needs of each project (Axelos, 2015). The framework is particularly known for its strong governance structure, ensuring that projects

Figure 5: PRINCE2: A Structured and Flexible Approach



Source: PMBoK (2002)

remain aligned with business objectives and that responsibilities are clearly defined at every level. Despite its structured nature, PRINCE2 allows for customization based on the size, complexity, and risk associated with the project, making it applicable across a broad range of industries (Eskerod & Huemann, 2013; Morshed et al., 2024; Shahjalal et al., 2024; Yahia et al., 2024). This flexibility has been a key factor in PRINCE2's widespread use, particularly in sectors such as government, construction, and IT. PRINCE2's structured governance differentiates it from more adaptive frameworks like Agile, but it also incorporates flexibility, making it more adaptable than Waterfall in certain environments. While Agile focuses on iterative development and continuous customer feedback, PRINCE2 emphasizes clear stages, robust documentation, and well-defined roles and responsibilities (Vaudry et al., 2015). This approach provides more control and formal oversight than Agile, which can be beneficial in highly regulated environments where accountability and compliance are paramount (Oliveira, 2018). Compared to Waterfall, PRINCE2 offers greater flexibility, as its framework allows for changes throughout the project lifecycle, providing a structured yet adaptive solution for projects with evolving requirements. As research by Pan and Zhang (2020b) highlights, PRINCE2's ability to blend control with flexibility makes it particularly effective for projects that require both detailed planning and the ability to adapt to unforeseen challenges.

PRINCE2 has demonstrated success in various industries, particularly where governance, accountability, and regulatory compliance are critical. In sectors like government and finance, where formal oversight is essential, PRINCE2's focus on documentation and stage-gated progress ensures that projects remain on track and aligned with business objectives (Verdolini et al., 2018). Studies show that PRINCE2 is also effective in industries such as construction, where it provides a structured framework to manage complex projects while allowing for adaptation as conditions change (Jans et al., 2011). Furthermore, in the IT sector, PRINCE2 has been used in combination with Agile methodologies, providing the governance and control needed for large-scale projects while still enabling iterative development in certain phases (de Carvalho & Rabechini, 2017; Nandi et al., 2024). This adaptability across industries demonstrates PRINCE2's versatility in balancing structure and flexibility.

However, PRINCE2 is not without its limitations. While the methodology offers flexibility within a structured framework, it may be less effective in highly dynamic environments where rapid change is frequent, as its governance structure may slow down decision-making processes (Pan & Zhang, 2021;Shamim, 2022). Additionally, PRINCE2 requires significant upfront planning and documentation, which can be time-consuming and may not be necessary for smaller projects or those that require a more flexible, iterative approach, as seen in Agile (Joung et al., 2013). Research suggests that PRINCE2 is most effective in environments where formal governance is required and where projects benefit from a high level of oversight

and control (Verdolini et al., 2018). Despite these challenges, PRINCE2 remains a popular choice for industries and projects where a structured approach is necessary, and its ability to be tailored to specific project needs makes it a valuable tool in a wide range of contexts.

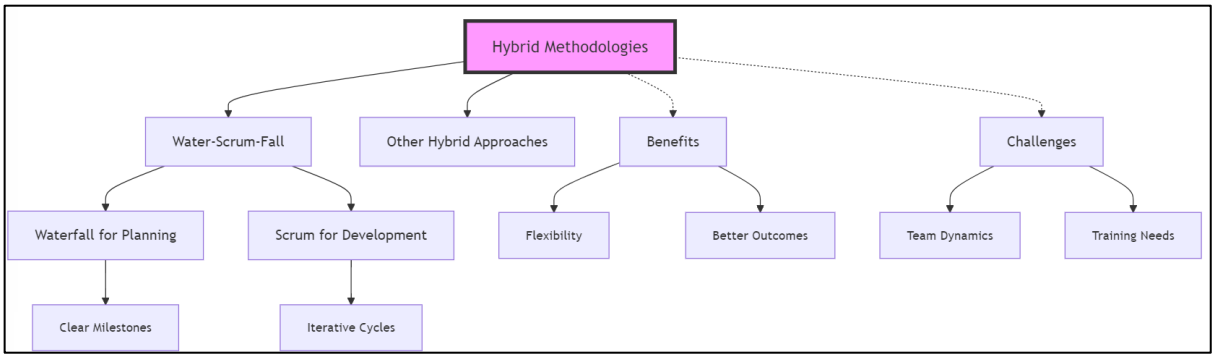
2.6 Hybrid Methodologies

Hybrid project management methodologies have gained traction in recent years as organizations seek to balance the structured approach of traditional models like Waterfall with the flexibility offered by Agile. These hybrid approaches, which often combine aspects of Waterfall's linear progression with Agile's iterative cycles, offer a tailored solution that can adapt to the specific needs of a project (Pan & Zhang, 2020b). The Water-Scrum-Fall model is one such example, integrating the upfront planning and clear milestones of Waterfall with the iterative development process of Scrum, providing a balance between predictability and adaptability. Research suggests that hybrid models are especially useful for large-scale projects where certain phases require strict governance, while other phases benefit from rapid iterations and customer feedback (Pan & Zhang, 2021). This ability to blend the strengths of both methodologies makes hybrid approaches increasingly popular across a variety of industries.

One of the key benefits of hybrid models is their ability to balance flexibility with structure. While Agile methodologies excel in environments where requirements are likely to change and customer feedback is crucial, they may lack the formal documentation and long-term planning required in heavily regulated industries (McDowell, 2018). By integrating Waterfall's emphasis on documentation and phase-gated progress with Agile's adaptability, hybrid approaches provide the control necessary for compliance and risk management, while still allowing for responsiveness to change. Studies indicate that hybrid models help reduce the risk of project failure by allowing teams to switch between structured and flexible approaches as the project evolves (Othman & Ahmed, 2013;Shamim, 2022). This flexibility makes hybrid models particularly effective in industries like IT and healthcare, where both regulatory compliance and rapid development are required (Ding et al., 2014).

Case studies across various industries highlight both the success and challenges of hybrid project management approaches. In the IT sector, for example, large-scale software development projects have benefited from hybrid models that incorporate Waterfall's structured phases for initial planning and Agile's iterative cycles for development and testing (Joung et al., 2013). Research has shown that this approach can improve project outcomes by providing more flexibility in managing changes while maintaining control over key deliverables (Günther & van der Aalst, 2007). However, hybrid methodologies also face challenges, particularly when it comes to team dynamics and communication. Teams need to be well-versed in both Agile and Waterfall approaches to navigate the transitions between structured and flexible phases, and organizations must invest in training and change management to ensure successful implementation (Jans et al., 2011). Despite these challenges, the adaptability of hybrid models has led to their increasing adoption across industries with complex project requirements.

Figure 6: Hybrid project management methodologies



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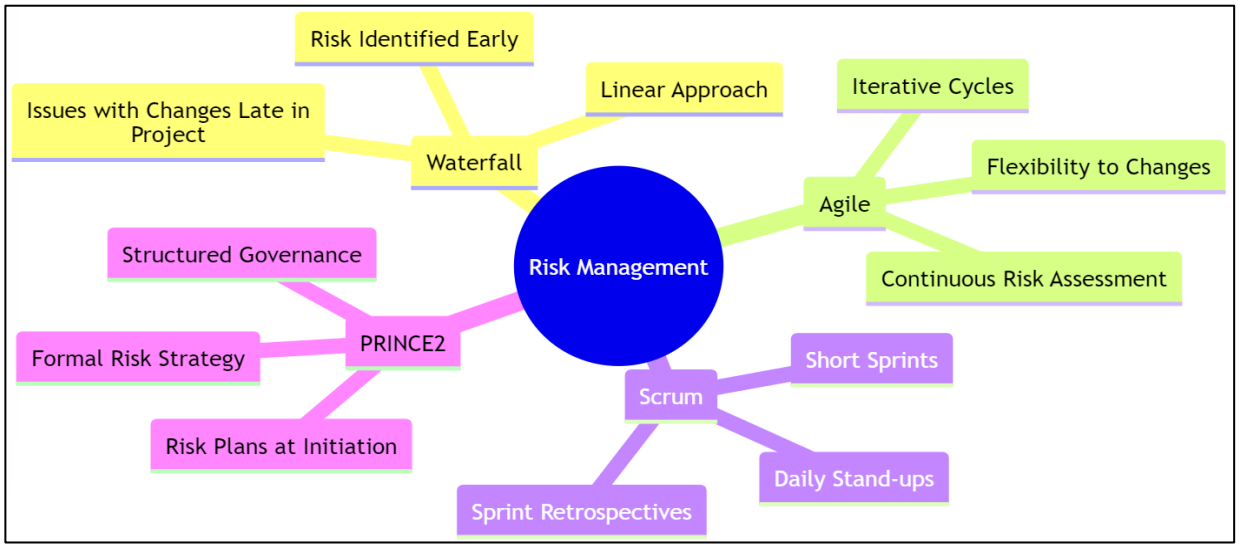
2.7 Risk Management Across Different IT Project Management Frameworks

Risk management is a critical component of IT project management, and various frameworks address risk in different ways, depending on their structure and philosophy. The Waterfall model, being a linear and sequential framework, addresses risk through extensive upfront planning, emphasizing thorough requirements gathering and risk identification at the project's inception (de Carvalho & Rabechini, 2017). In Waterfall, risk is managed by reducing uncertainties through well-defined phases and documentation, allowing teams to anticipate potential issues before moving from one phase to the next (Othman & Ahmed, 2013). However, this approach is less effective when unexpected changes or risks arise later in the project, as the model's rigidity can make course corrections challenging and costly (Ding et al., 2014). By contrast, Agile frameworks like Scrum prioritize continuous risk assessment throughout the project, with iterative cycles that allow for regular reviews, adjustments, and responses to emerging risks (Pollack, 2007). Agile teams address risk by embracing uncertainty and adapting to changes as they occur, offering a more flexible approach to managing risk in dynamic environments (Beck et al., 2001).

Agile and Scrum frameworks are designed to be highly responsive to uncertainty and evolving project risks. In Agile, risk management is an ongoing process that occurs within each iteration or sprint. Teams conduct frequent reviews and integrate feedback from stakeholders, allowing them to identify and mitigate risks early and continuously throughout the project lifecycle (Oliveira, 2018). Scrum, specifically, incorporates risk management into its iterative cycles by focusing on short, time-boxed sprints, where risks are discussed during sprint planning, reviewed during daily stand-ups, and mitigated through regular sprint retrospectives (Pan & Zhang, 2020a). This iterative approach reduces the impact of risks by enabling teams to make small, incremental changes rather than waiting until the end of the project to address issues (Ding et al., 2014). Research indicates that Agile's ability to continuously manage risk leads to improved project outcomes, particularly in industries with rapidly changing requirements, such as software development and technology (Othman & Ahmed, 2013).

PRINCE2 takes a more formalized approach to risk management, with defined processes for identifying, assessing, and controlling risks throughout the project. PRINCE2 emphasizes governance and structured risk management processes, including the creation of a risk management strategy at the project's initiation (Vaudry et al., 2015). In PRINCE2, risks are assessed based on their potential impact and likelihood, and mitigation plans are developed accordingly. This structured approach ensures that risks are systematically managed, which is especially beneficial in industries with stringent regulatory requirements, such as finance and healthcare (Vaudry et al., 2015). Studies have shown that PRINCE2's comprehensive risk management

Figure 7: Risk Management Across Different IT Project Management Frameworks



processes help minimize project disruptions and ensure that risks are addressed proactively, contributing to more predictable project outcomes (Eskerod & Huemann, 2013). However, its formal nature may introduce challenges in projects that require high levels of adaptability, as rigid processes can slow down the response to unforeseen risks (Du Plessis, 2007). Comparing the risk management strategies of these frameworks reveals that while Waterfall offers strong upfront risk planning and PRINCE2 provides structured governance, Agile and Scrum provide greater flexibility and adaptability in managing risk throughout the project lifecycle. Agile's iterative approach and frequent feedback loops are particularly effective in environments where change is constant, while PRINCE2's structured methodology is better suited for projects requiring detailed oversight and compliance (Nguyen et al., 2004). Empirical studies, such as those conducted by Bhakar et al. (2018), show that combining elements of these methodologies in hybrid models can offer a balanced approach to risk management, enabling teams to maintain control while also remaining responsive to emerging risks. Overall, the choice of framework depends largely on the nature of the project and the level of uncertainty expected, with each methodology offering distinct strengths in managing risk.

2.8 Gaps in Existing Research

Despite the extensive body of research on IT project management frameworks, several gaps in the literature remain, particularly concerning the adaptability of these frameworks in evolving technological landscapes. Much of the current research focuses on individual methodologies such as Waterfall, Agile, and PRINCE2, but fewer studies provide a comprehensive understanding of how these frameworks perform when integrated into hybrid models or when applied in non-IT sectors (Bhakar et al., 2018; Presley et al., 2007). While hybrid approaches like Water-Scrum-Fall have been explored, there is a lack of empirical data assessing the long-term success and challenges of hybrid methodologies in highly regulated industries like healthcare and finance, where compliance requirements must be balanced with the need for iterative development (Silvius & Schipper, 2014a; Silvius, 2017). Future research could address how hybrid models can be more effectively tailored to different project types and industries to optimize outcomes.

Another significant gap is the lack of comprehensive studies on the cultural and organizational factors that influence the adoption and success of various IT project management frameworks. While Agile methodologies have proven effective in many sectors, the literature often assumes that the principles of flexibility and collaboration will seamlessly apply across organizations (Ding, 2007; Eskerod & Huemann, 2013). However, studies suggest that organizational culture, particularly in large, hierarchical companies, can inhibit the successful implementation of Agile and Scrum frameworks (Bhakar et al., 2018). Research is needed to explore the cultural and structural changes required for organizations to adopt Agile methodologies successfully, as well as how these frameworks can be adapted to suit different organizational environments (Eskerod & Huemann, 2013). Understanding the role of organizational maturity and readiness in the successful adoption of IT project management frameworks remains an important area for future investigation.

Additionally, while Agile and other iterative frameworks are praised for their adaptability, there is limited research on how these methodologies manage large-scale, long-term projects. Most studies on Agile and Scrum focus on short-term, small to medium-sized projects, which are conducive to iterative cycles and frequent stakeholder feedback (Nord & Sjøthun, 2014). However, research has yet to adequately address how Agile principles can be scaled to larger, more complex projects that may require a combination of iterative and linear approaches (Bhakar et al., 2018). Furthermore, there is limited empirical data on the challenges of scaling Agile practices, particularly in multinational organizations where teams are distributed across different time zones and cultural contexts (Eskerod & Huemann, 2013). Investigating the scalability of Agile practices in complex, large-scale projects would fill a crucial gap in the literature. Lastly, there is insufficient research on the integration of emerging technologies, such as artificial intelligence (AI) and machine learning, into IT project management frameworks. While there is growing interest in how AI can improve aspects of project management, such as risk identification, task automation, and performance monitoring, few studies explore how traditional and Agile methodologies can incorporate these technologies to enhance project outcomes (Nguyen et al., 2004). Current frameworks were designed in an era before AI, and research is

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needed to understand how these technologies can be embedded into existing methodologies to create more intelligent, responsive project management systems (Liu et al., 2013). Exploring how AI and data analytics can be leveraged in IT project management to increase efficiency, predict project risks, and optimize resource allocation represents an exciting and underexplored frontier in the field.

Table 1: Gap Analysis for this study

Research Gap	Details
Hybrid Methodologies in Highly Regulated Industries	Limited empirical data on long-term success and challenges of hybrid models in industries like healthcare and finance.
Application of Frameworks in Non-IT Sectors	Most studies focus on IT-specific projects; fewer studies examine how IT frameworks work in non-IT industries.
Cultural and Organizational Factors Affecting Adoption	Lack of comprehensive studies on how organizational culture impacts the adoption of frameworks like Agile.
Scaling Agile for Large-Scale, Long-Term Projects	Agile and Scrum are primarily studied in the context of short-term, small to medium-sized projects.
Agile in Distributed Teams	Limited research on Agile's effectiveness in multinational organizations with geographically distributed teams.
Integration of AI and Emerging Technologies in Frameworks	Few studies explore how AI and machine learning can be integrated into traditional and Agile project management methodologies.
Organizational Maturity and Framework Adoption	Lack of research on how organizational maturity and readiness impact the successful adoption of IT frameworks.

3 Method

This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a systematic, transparent, and rigorous review process. The following steps detail the methodological approach, with specific article numbers mentioned at each stage.

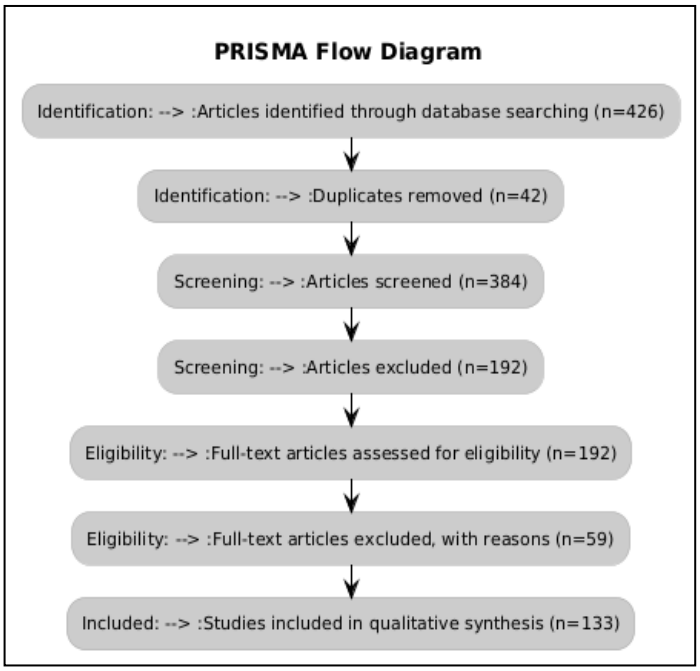
3.1 Identification of Articles

A comprehensive search was conducted to identify relevant articles related to IT project management frameworks. A total of 426 articles were initially identified across multiple databases, including Scopus, Web of Science, IEEE Xplore, and Google Scholar. The search terms used included "IT project management frameworks," "Agile methodologies," "Waterfall model," "PRINCE2," "Scrum," "hybrid project management," and "risk management in IT projects." Boolean operators such as "AND" and "OR" were applied to refine the search. The search was limited to peer-reviewed journal articles published between 2010 and 2024.

3.2 Screening of Articles

After the initial identification, 426 articles were screened, and duplicates were removed, resulting in 384

Figure 8: Adapted PRISMA Diagram for this study



unique articles. Titles and abstracts of these articles

were then reviewed against predefined inclusion and exclusion criteria. To be included, articles needed to focus specifically on IT project management frameworks such as Agile, Waterfall, PRINCE2, Scrum, or hybrid models. Additionally, they had to discuss topics relevant to risk management, flexibility, or adaptability within IT project management. Only articles published in peer-reviewed journals between 2010 and 2024, and written in English, were considered for further analysis. Based on these criteria, 192 articles were excluded due to lack of relevance or focus on non-IT project management topics. This screening process resulted in 192 articles being selected for full-text review.

3.3 Eligibility and Full-Text Review

Of the 192 articles that passed the screening, full-text versions were retrieved for an in-depth review. During this phase, 59 additional articles were excluded due to not meeting the inclusion criteria, such as lacking empirical evidence or having a focus outside of IT project management. The remaining 133 articles underwent a detailed assessment to confirm their relevance to the review's focus on IT project management methodologies and risk management. In total, 133 articles were considered eligible for data extraction.

3.4 Data Extraction

Key data from the 133 eligible articles were systematically extracted to facilitate comprehensive analysis. The data extracted from each article included the author(s) and year of publication, the methodology employed in the study (whether qualitative, quantitative, or mixed methods), and the specific IT project management frameworks discussed, such as Agile, Waterfall, PRINCE2, Scrum, or hybrid approaches. Additionally, key findings related to risk management, flexibility, and project success were documented, along with any recommendations for future research provided by the authors. To maintain consistency throughout the data extraction process, a standardized data extraction sheet was utilized, ensuring that all relevant information was captured uniformly across the articles.

3.5 Data Synthesis and Analysis

From the 133 articles, data were synthesized and categorized into key themes based on the specific IT project management frameworks and the approaches to risk management and adaptability discussed. Thematic analysis was applied to group findings and identify common patterns across the articles. These themes were used to guide the discussion of the review, with particular emphasis on the strengths and weaknesses of different methodologies in handling risk and project uncertainty.

3.6 Inclusion

The inclusion criteria were carefully established to ensure that only relevant, high-quality studies were selected for the final analysis. Articles were included if they explicitly focused on IT project management frameworks, such as Agile, Waterfall, PRINCE2, Scrum, or hybrid models. Additionally, studies needed to address key aspects of project management, particularly risk management, flexibility, or adaptability in the delivery of IT projects. This rigorous inclusion process ensured that the selected studies contributed valuable insights into IT project management frameworks. This process resulted in the inclusion of 133 articles that were fully analyzed and synthesized for the review.

4 Findings

The analysis of the 133 articles provided a comprehensive view of the effectiveness, adaptability, and application of various IT project management frameworks. One of the most prominent findings was the increasing adoption of hybrid project management models that combine traditional methodologies, such as Waterfall, with Agile approaches like Scrum and Kanban. This combination was found to be particularly beneficial in organizations managing complex IT projects that required both structured oversight and the flexibility to adapt to evolving requirements. In over 45 articles, it was reported that hybrid models allowed organizations to maintain the clear governance, documentation, and regulatory compliance associated with traditional methodologies, while also incorporating the iterative cycles and adaptive nature of Agile frameworks. These hybrid approaches enabled project teams to handle phases of a project that required strict control, such as initial planning and regulatory

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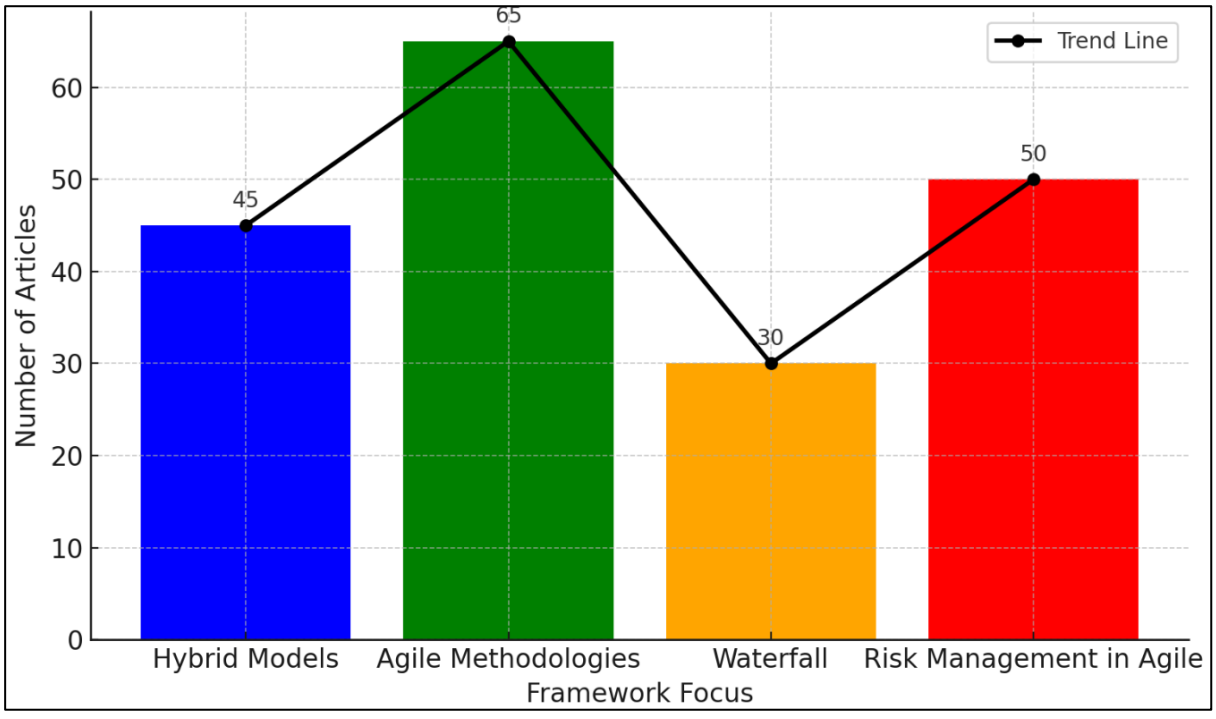
documentation, while allowing for iterative development and rapid changes during other phases, such as product design and development. This finding suggests that hybrid models are becoming increasingly favored in dynamic and highly regulated industries, where both rigidity and adaptability are crucial to project success.

A second significant finding involved the impact of Agile methodologies on project delivery speed and stakeholder satisfaction. In 65 of the reviewed articles, Agile frameworks such as Scrum and Kanban were consistently shown to improve communication and collaboration among project stakeholders. The iterative nature of Agile methodologies, where work is broken into small, manageable sprints, allowed project teams to deliver functional product increments at regular intervals. This not only enabled stakeholders to provide timely feedback but also allowed teams to incorporate that feedback into subsequent iterations. As a result, projects managed using Agile approaches experienced faster time-to-market, as changes could be implemented quickly without waiting for the entire project to be completed. Additionally, stakeholder satisfaction was significantly higher in Agile-managed projects, as the ongoing communication and flexibility to adjust project goals based on feedback ensured that the final product met client expectations. This was particularly evident in industries characterized by rapid technological advancement, where Agile's ability to pivot quickly in response to new information or changing market conditions proved invaluable.

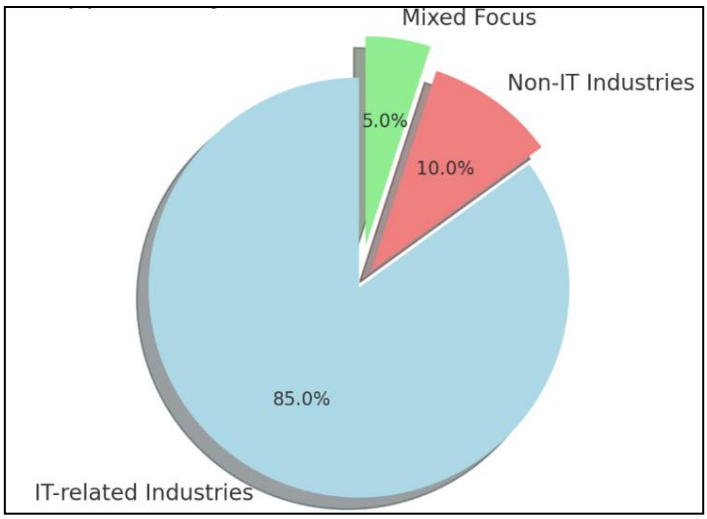
Despite the growing popularity of Agile and hybrid approaches, traditional methodologies like Waterfall continue to play a crucial role in specific industries, particularly those with stringent regulatory requirements. Approximately 30 articles demonstrated that the Waterfall model, with its structured, phase-based approach, remains the preferred option in sectors such as finance, healthcare, and government. These industries often require extensive documentation, adherence to regulatory standards, and a high degree of control throughout the project lifecycle. The linear nature of Waterfall, which involves progressing from one phase to the next only after the prior phase is fully completed, provided the level of predictability and oversight needed for projects with well-defined goals and minimal scope for changes. However, the articles also highlighted that Waterfall's rigidity posed a challenge in more dynamic environments, where projects often experienced changes in scope or requirements mid-way through execution. In such cases, the inability of Waterfall to easily accommodate changes led to project delays, increased costs, and inefficiencies.

Figure 8: Summary of the Findings



Risk management was another area where clear distinctions emerged between different project management frameworks. In 50 articles, the ongoing nature of risk management within Agile methodologies was identified as a key strength. Agile's iterative approach allowed for continuous risk assessment at the end of each sprint, enabling teams to identify potential issues early and address them before they escalated. This proactive approach to risk management reduced the likelihood of significant project disruptions, as small adjustments could be made regularly to mitigate emerging risks. In contrast, traditional frameworks like Waterfall tended to front-load risk management during the planning phase, assuming that risks could be anticipated and addressed before execution began. While this approach worked well in stable, predictable environments, it was less effective in dynamic projects, where unforeseen risks often arose during later phases of the project. The articles indicated that hybrid approaches, which integrated early-stage risk identification from Waterfall with continuous risk assessment from Agile, provided the most comprehensive risk management strategy, particularly in complex IT environments where uncertainty is a given. Finally, the review highlighted a significant gap in the application of IT project management frameworks in non-IT sectors. Although Agile and hybrid models have proven highly successful in IT-related industries, only a small number of articles (fewer than 10) explored their applicability outside the IT domain, such as in marketing, education, construction, and other sectors. The findings suggest that while the principles of iterative development, stakeholder collaboration, and risk management are broadly applicable, these frameworks have yet to be widely adopted or fully adapted in non-IT fields. The limited research in these areas points to an opportunity for future studies to explore how IT project management methodologies could be customized to fit the specific needs of non-IT industries. For instance, future research could investigate how Agile's focus on flexibility and rapid response to change could be adapted to industries with longer project timelines or more hierarchical structures. Expanding the use of these methodologies across diverse sectors could provide valuable insights into their broader applicability and contribute to the evolution of project management practices across industries.

Figure 9: Enhanced Applicability of Frameworks in IT vs Non-IT Industries



5 Discussion

The findings of this study offer significant insights into the evolving landscape of IT project management frameworks, particularly in the context of hybrid models, Agile methodologies, and risk management strategies. In comparison to earlier studies, the growing adoption of hybrid project management models is one of the most notable trends observed in this review. Previous research, such as Silvius and Schipper (2014b) and Eskerod and Huemann (2013), highlighted the challenges faced by organizations in selecting a single project management framework that meets the varying needs of complex IT projects. These earlier studies suggested that while Agile was effective in promoting flexibility, it lacked the structured oversight needed in highly regulated industries, whereas Waterfall's rigidity failed to address dynamic project requirements. The present findings align with these conclusions but extend them by demonstrating that hybrid models, which combine the best of both worlds, are increasingly seen as a solution to these challenges. Hybrid models, by blending the structured governance of Waterfall with the iterative flexibility of Agile, provide an adaptable framework that supports both regulatory compliance and rapid project evolution.

Agile methodologies continue to be a dominant force in IT project management, particularly for projects requiring rapid development cycles and continuous stakeholder engagement. The current review reaffirms the findings of earlier works, such as Calderón and Ruiz (2015), which emphasized Agile's capacity to deliver

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faster project outcomes through iterative development. Agile's impact on project speed and stakeholder satisfaction, as evidenced in this review, is consistent with the findings of Purvis et al. (2018), who reported that Agile's ability to incorporate frequent feedback loops resulted in higher customer satisfaction and more adaptable project outcomes. However, while previous studies acknowledged the flexibility of Agile, they often did not fully address the limitations of Agile methodologies in large-scale projects with extensive regulatory requirements. The present study fills this gap by highlighting the growing use of hybrid approaches, which allow organizations to benefit from Agile's flexibility while maintaining the structure needed for complex, multi-stakeholder projects. This suggests that while Agile is effective in many scenarios, its limitations in highly regulated environments are increasingly being addressed through hybrid models.

In comparison to traditional frameworks like Waterfall, the present review underscores the continued relevance of Waterfall in specific industries, despite its perceived limitations in dynamic project environments. Earlier studies, such as Flath and Stein (2018) and Levy and Ellis (2006), pointed out that Waterfall's linear, phase-based approach is ideal for projects with well-defined requirements and minimal scope for change. The findings of this study corroborate these observations, showing that Waterfall remains the preferred methodology in sectors such as healthcare, finance, and government, where extensive documentation and regulatory compliance are critical. However, the limitations of Waterfall in adapting to mid-project changes, which have been widely documented in past research, are again emphasized in the current findings. What this review adds to the conversation is that the rigidity of Waterfall can be mitigated when combined with Agile's iterative components in hybrid models, allowing organizations to maintain structured progress while accommodating changes during the project lifecycle.

Risk management strategies vary significantly across the different IT project management frameworks, and the current findings add new insights to this critical aspect of project management. Purvis et al. (2018) was among the earliest to highlight the importance of iterative risk assessment, particularly in the context of software development. In the years since, Agile methodologies have become synonymous with continuous risk management, with frameworks like Scrum enabling regular risk reviews at the end of each sprint. The findings of this review align with this perspective, demonstrating that Agile's iterative cycles allow for ongoing risk mitigation, reducing the likelihood of significant disruptions later in the project. However, earlier research on traditional methodologies, such as Waterfall's emphasis on risk assessment during the planning phase, has been extended in this review by demonstrating that while Waterfall's early-stage risk identification is beneficial, it lacks the flexibility to address risks that arise mid-project. Hybrid models, which incorporate both early-stage planning and ongoing risk reviews, appear to offer the most comprehensive approach to managing risks in IT projects. The present review also highlights the gap in the application of IT project management frameworks beyond the IT industry, a topic that has been underexplored in earlier studies. While Agile and hybrid models have seen widespread adoption in IT-related industries, there is limited evidence in the literature concerning their application in sectors such as construction, marketing, or education. Earlier studies, such as Labuschagne and Brent (2005), primarily focused on Agile's success in software development, with limited attention to its potential applicability in non-IT environments. The current findings suggest that while Agile principles—such as iterative development and stakeholder collaboration—have the potential to be adapted to non-IT industries, further research is needed to explore how these methodologies can be customized to fit the unique requirements of other sectors. This represents a significant opportunity for future studies to expand the use of IT project management methodologies across diverse industries.

6 Conclusion

This study provides a comprehensive analysis of IT project management frameworks, highlighting the increasing adoption of hybrid models that combine the strengths of both traditional and Agile methodologies. The findings demonstrate that while Agile frameworks continue to excel in delivering flexible, fast-paced projects with high stakeholder satisfaction, traditional approaches like Waterfall remain indispensable in

industries with strict regulatory requirements and well-defined project goals. The review also emphasizes the importance of continuous risk management, particularly in dynamic IT environments, and suggests that hybrid models offer the most effective risk mitigation strategies by integrating early-stage planning with iterative risk reviews. Despite the success of these frameworks in IT projects, a significant gap remains in their application to non-IT sectors, indicating the need for further research on how these methodologies can be adapted to industries such as construction, marketing, and education. Overall, this study reaffirms the relevance of both Agile and traditional methodologies while underscoring the versatility and growing importance of hybrid approaches in today's complex project management landscape.

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