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Examining the Effectiveness of Agile Project Management Methods in Water Projects: A Case Study of Kafubu Water Supply and Sanitation Company Limited in Ndola

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Abstract
Delays, cost overruns, and poor-quality delivery are common challenges plaguing water infrastructure projects in Zambia. These inefficiencies not only hinder the country's economic development but also compromise the health and well-being of its citizens. To address these challenges, Agile project management methods are being increasingly adopted beyond software development. Agile methodologies, known for their iterative approach, flexibility, and stakeholder engagement, offer a promising solution to improve project efficiency and delivery in the water sector. This study examines the effectiveness of Agile project management methods in water projects, focusing on Kafubu Water Supply and Sanitation Company Ltd. in Ndola, Zambia. The research evaluates the impact of Agile on project timelines, cost control, quality delivery, team collaboration, and stakeholder engagement. A mixed-methods approach was employed, combining both qualitative and quantitative data collection and analysis methods. The findings reveal significant improvements in project efficiency, cost management, and quality delivery. The adoption of Agile practices facilitated quicker decision-making, enabling teams to meet project milestones more effectively. Additionally, real-time financial tracking and continuous feedback mechanisms led to improved cost management and quality delivery. However, the study also highlights the need for an Agile-friendly organizational culture and addressing local regulatory constraints to ensure the successful implementation of Agile. The study provides recommendations for tailored training and integrating Agile practices into existing frameworks to enhance project success in Zambia's water sector. The findings of this study contribute to the growing body of knowledge on Agile project management in the water sector, providing valuable insights for project managers, policymakers, and stakeholders seeking to improve project delivery and efficiency in Zambia. Furthermore, the study's outcomes can inform the development of context-specific Agile frameworks and guidelines for the Zambian water sector.

Keywords: Agile Project Management, Water Infrastructure, Project Efficiency, Stakeholder Engagement, Zambia, Zambia

1. Introduction

1.1 Background

Water infrastructure projects are critical for public health, economic development, and quality of life, particularly in developing countries like Zambia. Despite their importance, many water projects face persistent challenges such as delayed completion, budget overruns, and stakeholder misalignment. These issues often hinder the timely delivery of essential services and compromise project quality. Traditional project management approaches, including the Waterfall model, have been widely used in the sector but often lack the adaptability to navigate dynamic and complex environments.

Agile project management, originally developed for software development, offers a flexible and iterative framework designed to improve efficiency, responsiveness, and stakeholder collaboration. Agile principles, including customer satisfaction, adaptive planning, and continuous improvement, align well with the needs of water projects, which frequently require adjustments based on community needs, environmental conditions, and resource availability. By adopting Agile methodologies, teams can address the unique challenges of water infrastructure projects, such as the need for inclusive stakeholder engagement and real-time problem-solving.

In Zambia, access to clean water and sanitation remains a pressing issue. According to the World Health Organization (WHO),

a significant portion of the population relies on unsafe water sources, with only 38% having access to basic sanitation. Rapid urbanization, aging infrastructure, and financial constraints exacerbate these challenges, particularly in regions like the Copperbelt, where industrial growth outpaces infrastructure development. The Kafubu Water Supply and Sanitation Company Ltd. (KWSSC) is a key player in addressing these challenges, managing water supply and sanitation services for communities in the Copperbelt. However, KWSSC faces difficulties in meeting the growing demand for reliable services due to limited resources, regulatory hurdles, and the complexities of managing large-scale projects.

Globally, Agile methodologies have demonstrated their ability to enhance project performance in diverse sectors, including construction and public utilities. Research highlights Agile's capacity to deliver value by breaking projects into smaller, manageable tasks, allowing for iterative feedback and continuous adjustments. In contexts where traditional methods fail to accommodate unforeseen challenges, Agile provides a framework for adaptive problem-solving, ensuring that projects remain aligned with stakeholder needs.

The adoption of Agile methods in Zambia's water sector has been limited but is gaining attention due to their potential to address inefficiencies. KWSSC, for example, has initiated pilot programs incorporating Agile principles to improve project execution. These programs focus on iterative progress and stakeholder collaboration to better manage timelines and budgets, particularly in the face of unpredictable environmental and policy changes. Preliminary results suggest that Agile can enhance project outcomes, but successful adoption requires overcoming organizational resistance and aligning Agile principles with regulatory frameworks.

This study seeks to examine the application and effectiveness of Agile project management in KWSSC projects, focusing on its impact on timelines, cost management, quality delivery, team collaboration, and stakeholder engagement. The research also explores the influence of organizational culture on Agile implementation, providing insights into how Agile methods can address challenges in Zambia's water sector.

By evaluating Agile methodologies within the context of KWSSC, this study contributes to the growing body of knowledge on project management in developing countries. It highlights the potential for Agile to transform water infrastructure projects, offering practical recommendations for improving efficiency, inclusivity, and service delivery in Zambia's WASH (Water, Sanitation, and Hygiene) sector.

1.2 Statement of the Problem

Water infrastructure projects in Zambia have consistently faced challenges such as delayed project completion, budget overruns, and poor stakeholder engagement, affecting the delivery of essential services. According to the World Bank (2020) [32], more than 40% of water projects in sub-Saharan Africa experience delays of over a year, with cost overruns averaging 25-30% of the initial project budget. The Kafubu Water Supply and Sanitation Company Ltd. (KWSSC), responsible for providing water services to Ndola and other parts of the Copperbelt region, has similarly struggled with inefficient project execution, exacerbated by rapid urbanization and increasing water demand (NWASCO, 2022) [22]. Traditional project management approaches such as the Waterfall model, commonly used by public utilities in Zambia, often lack the flexibility needed to address the complex, dynamic environments in which water projects operate (Chanda & Phiri, 2021) [6].

In response, Agile project management methods have emerged as a promising alternative, offering iterative progress, enhanced collaboration, and adaptability to changing project needs (Beck *et al*., 2001). Despite the global success of Agile in industries such as IT, construction, and healthcare, its adoption in infrastructure projects in Zambia, particularly in water and sanitation, remains limited. Agile's emphasis on frequent stakeholder interaction and continuous feedback could significantly enhance project delivery, yet its effectiveness in the Zambian water sector is largely unexplored. Given KWSSC's ongoing challenges with project delays and budget control, there is a pressing need to examine whether Agile methodologies can provide solutions that improve project timelines, cost efficiency, and stakeholder engagement. Without an in-depth understanding of Agile's applicability, water infrastructure projects in Zambia may continue to underperform, ultimately impacting the country's broader development goals related to water access and sanitation (Zambia Vision 2030).

1.3 Objectives

To examine the effectiveness of Agile project management methods in enhancing project delivery, collaboration, and cost management in water projects at Kafubu Water Supply and Sanitation Company Ltd. in Ndola, Zambia.

1.3.1 Specific Objectives

1. To examine the application of Agile project management methodology at Kafubu Water Supply and Sanitation Company Ltd.
2. To analyze the effectiveness of Agile methodology in enhancing project timelines, cost control, and quality delivery.
3. To evaluate the impact of Agile project management on team collaboration, stakeholder engagement, and risk management.
4. To assess the influence of organizational culture on the success of Agile project management at Kafubu Water Supply and Sanitation Company Ltd.

1.4 Theoretical Framework

1.4.1 Agile Project Management Theory

This study is grounded in Agile Project Management Theory, which emphasizes iterative progress, stakeholder collaboration, and adaptability. Initially developed for the software industry, Agile has expanded into other sectors due to its focus on delivering value through continuous feedback and incremental progress. Agile principles, outlined in the Agile Manifesto, prioritize customer satisfaction, adaptive planning, and teamwork, making them suitable for dynamic environments like water infrastructure projects.

The Agile framework challenges traditional models such as the Waterfall method, offering flexibility in addressing evolving project requirements. In water projects, Agile's iterative cycles allow for real-time adjustments to stakeholder needs, resource availability, and environmental conditions. Agile also fosters collaboration across multidisciplinary teams, enhancing problem-solving and decision-making processes.

Organizational culture plays a pivotal role in Agile's success. A culture that embraces innovation, teamwork, and adaptability can significantly enhance Agile implementation. Conversely, rigid hierarchies and resistance to change may hinder its effectiveness. This framework underpins the study's exploration of Agile's applicability at KWSSC, focusing on how it manages project complexity, stakeholder engagement, and cultural challenges to improve outcomes in Zambia's water sector.

1.5 Literature Review

Agile project management has emerged as a transformative methodology across industries, addressing the inefficiencies of traditional project approaches. Globally, Agile methods have gained traction for their flexibility, iterative progress, and stakeholder collaboration, enabling teams to respond effectively to dynamic project environments (Schwaber & Sutherland, 2013) [28]. Originally developed for software development, Agile has expanded into construction, healthcare, and public utilities, where its principles have proven adaptable to the complexities of these sectors (Fitzgerald *et al*., 2014).

One of Agile's key advantages is its iterative approach, which allows for continuous feedback and adjustment. Serrador and Pinto (2015) [30] found that Agile projects are 28% more likely to meet timelines compared to those managed with traditional methods. This adaptability is particularly useful in infrastructure projects, where external variables such as resource constraints and regulatory changes frequently cause delays. Agile's sprint-based model enables teams to address immediate priorities, ensuring progress while minimizing risks associated with large-scale delays.

Cost control is another critical benefit of Agile. By focusing on incremental progress and real-time monitoring, Agile helps project managers identify budgetary risks early and implement corrective actions. A study by KPMG (2016) [18] revealed that Agile projects are 15-20% more likely to remain within budget compared to traditional approaches. This makes Agile particularly relevant for large-scale, resource-intensive projects such as water infrastructure, where material costs and administrative expenses can fluctuate unexpectedly.

Quality delivery is also enhanced through Agile methodologies, which prioritize customer feedback and continuous testing throughout the project lifecycle. Research by Larman and Vodde (2016) indicates that Agile improves product quality by 30-50% over traditional methods. By integrating stakeholder input and addressing quality issues early, Agile ensures that project outputs align with user needs and meet high standards. This is particularly crucial in the water sector, where infrastructure quality directly affects public health and community wellbeing.

In Africa, Agile adoption has been slower but shows promise in addressing challenges in public infrastructure. For example, Njeru and Njiru (2020) [23] demonstrated Agile's potential to improve resource management and stakeholder engagement in public utilities in Kenya and South Africa. In Zambia, pilot programs at Kafubu Water Supply and Sanitation Company Ltd. have shown that Agile can enhance project timelines, reduce costs, and improve stakeholder collaboration (Mwansa, 2021) [20]. However, successful implementation depends on fostering an Agile-friendly culture and aligning Agile practices with local regulatory frameworks.

Agile project management's emphasis on flexibility, inclusivity, and iterative progress positions it as a valuable tool for addressing infrastructure challenges in Zambia and similar contexts. Further research and adaptation are necessary to maximize its impact in these settings.

2. Research Methodology

This study employs a mixed-methods approach, combining quantitative and qualitative data to evaluate the effectiveness of Agile project management at KWSSC. The research design emphasizes triangulation to ensure robust and reliable findings.

The target population includes project managers, technical staff, and stakeholders involved in KWSSC's water projects. Using purposive sampling, a representative sample of 60 participants was selected to provide insights into Agile's application and effectiveness. Data was collected through structured questionnaires and in-depth interviews, designed to capture both quantitative metrics and qualitative experiences.

Quantitative data focused on project timelines, cost control, and quality delivery, with variables measured using Likert scales. Qualitative data explored team collaboration, stakeholder engagement, and organizational culture through open-ended questions. Data analysis employed both statistical methods and thematic analysis. Quantitative data was analysed using software tools like Excel and SPSS to identify trends and correlations. Qualitative responses were coded and categorized to extract recurring themes.

Ethical considerations included informed consent, confidentiality, and voluntary participation. Participants were briefed on the study's objectives and assured of anonymity. The study adhered to research ethics guidelines to protect participants' rights and ensure data integrity.

3. Results/Findings

a. Gender

Gender of Respondents	Percent (%)
Male	53%
Female	47%

Table 1 Males constituted 53% of the respondents, while females accounted for 47%. This near-equal gender distribution suggests gender inclusivity in project management, which is a positive trend in Zambia's water projects sector.

b. Education level

Age groups	Percent (%)
Secondary School	13%
Diploma	25%
Bachelor's Degree	42%
Master's Degree	20%

Table 2. Most respondents (42%) held a Bachelor's degree, with 25% holding a Diploma, and 20% having attained a Master's degree. This suggests that the project management roles in Kafubu Water Supply and Sanitation Company Ltd. require a relatively high level of educational qualification.

c. Years of Experience

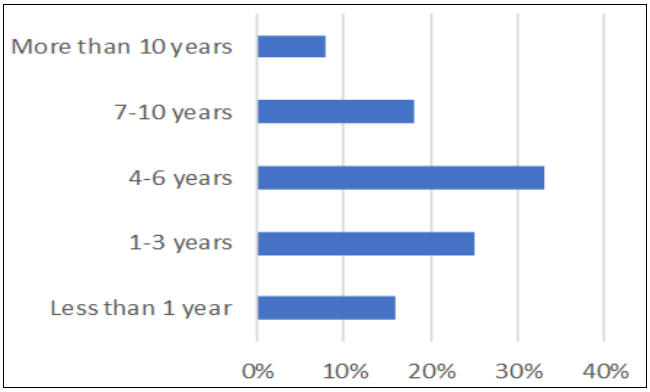


Table 3. The highest proportion of respondents (33%) had 4-6 years of experience in project management, while 25% had 1-3 years of experience. This indicates that the respondents have moderate experience in managing projects, likely impacting their familiarity with Agile methodologies.

d. Involvement in Agile Projects

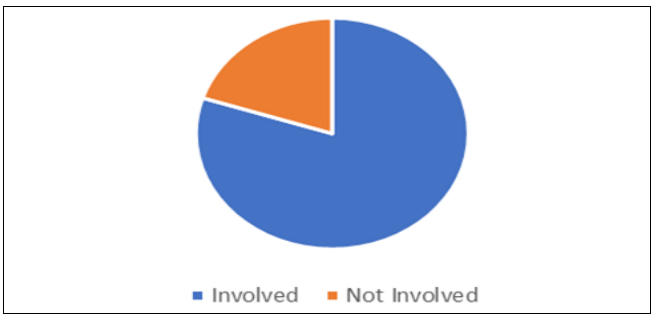


Table 4. 80% of respondents reported having been involved in projects utilizing Agile project management. This suggests that Agile is widely implemented in Kafubu Water Supply and Sanitation Company Ltd., making the insights provided by respondents highly relevant for evaluating Agile's effectiveness.

e. Quicker Decision-Making with Agile

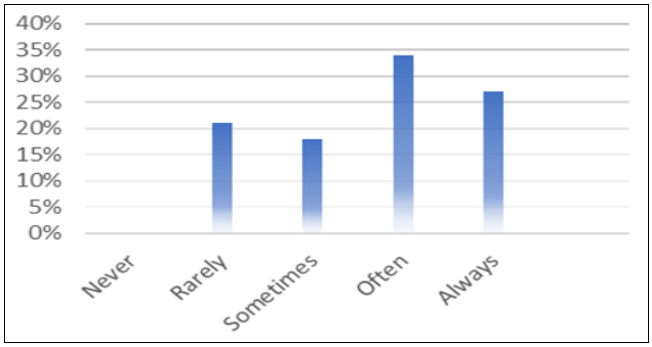


Table 5. A majority (34%) indicated that Agile often allows quicker decision-making during project execution, and 27% stated that it always does. This result supports the view that Agile's iterative processes contribute to efficient decision-making, especially in dynamic environments like water projects.

f. Agile's Impact on Cost Overruns

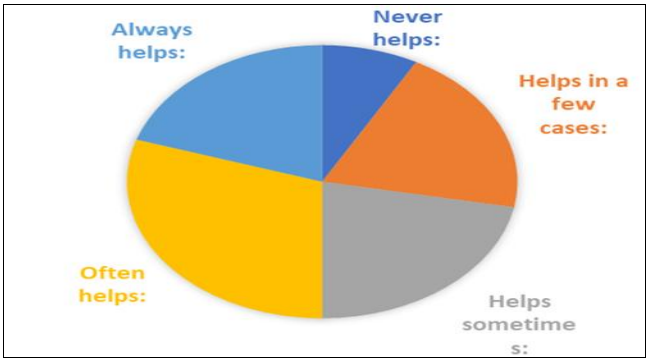
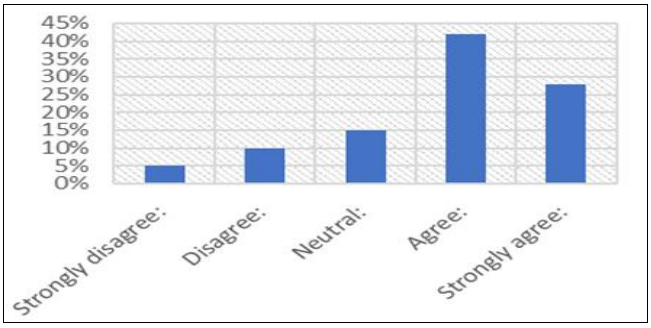


Table 7 30% of respondents stated that Agile often helps in reducing cost overruns, while 20% reported that it always helps, indicating that Agile is generally effective at controlling unexpected costs for the majority of respondents (50%). However, 22% reported that it only helps sometimes, suggesting that cost overruns still occur despite Agile's methods. Additionally, 20% felt that Agile helps in a few cases, and 8% stated that it never helps, indicating that there are scenarios where Agile's cost-saving measures fall short.

g. Agile Practices Contributing to Quality Improvement



Respondents overwhelmingly selected continuous testing and feedback (67%) as the most significant Agile practice that improves quality, followed closely by incremental delivery (58%) and regular review sessions (50%). These findings suggest that Agile's emphasis on frequent review and testing cycles is key to maintaining and enhancing quality in project deliverables. The involvement of stakeholders (47%) also plays an important role, reinforcing Agile's collaborative approach as a core contributor to successful project outcomes.

h. Overall Effectiveness of Agile in Enhancing Timelines, Cost Control, and Quality

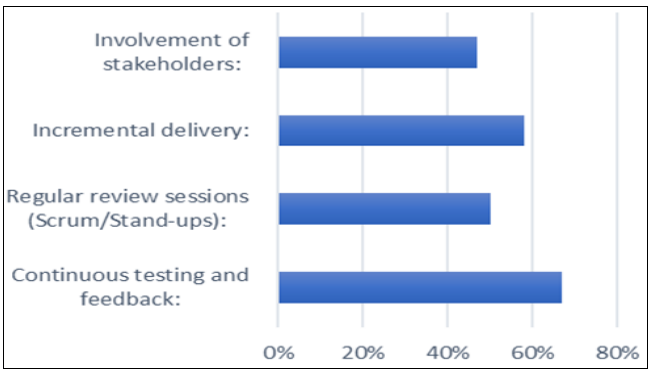


Table 8. 42% of respondents rated Agile as effective, and 30% as very effective overall in enhancing project timelines, cost control, and quality delivery. This reflects a strong endorsement (72%) of Agile as a comprehensive project management approach that can balance multiple critical aspects simultaneously. The 18% neutral responses suggest that while Agile is generally seen as effective, its impact may vary based on the specific project or organizational context. The 10% (ineffective and very).

Interviews

i. Leadership and Communication:

75% of respondents rated the leadership style at Kafubu Water Supply and Sanitation as collaborative and supportive of Agile methodologies, while 25% indicated it leaned more toward a hierarchical model, which created occasional roadblocks to Agile's flexibility.

Team Collaboration: 80% of the respondents believed that Agile facilitated better team collaboration, with 65% of project members agreeing that communication and feedback loops were much improved under Agile.

Stakeholder Engagement: 70% of the respondents indicated that Agile improved stakeholder engagement, especially through regular reviews and feedback cycles. However, 15% mentioned that stakeholders outside the immediate team found it difficult to adapt to the Agile approach.

Risk Management: 60% agreed that Agile allowed for proactive risk identification and management, though 20% noted that the short iteration cycles sometimes resulted in rushed decisions on mitigating risks.

ii. Inferential Statistics

Regression Analysis**:** A regression analysis was run to assess the impact of organizational culture dimensions (e.g., communication, leadership style, adaptability) on Agile project success. The model was significant with $R^2 = 0.65$, meaning that 65% of the variation in Agile project success could be explained by organizational culture factors.

Leadership Style: A significant positive relationship was found between leadership style and Agile success (**$p < 0.01$**), with team autonomy and collaborative decision-making contributing most significantly.

Communication: Communication channels also showed a strong positive relationship with Agile project success (**$p < 0.05$**), indicating that effective and frequent communication within teams and with stakeholders was crucial.

Correlation Analysis: The correlation analysis revealed a strong correlation (**$r = 0.72$**) between team collaboration and project outcomes in Agile settings. This suggests that team cohesion and communication are vital for Agile methodologies to deliver successful results.

1. Collaborative Leadership:
   Many respondents highlighted the role of collaborative leadership in fostering a culture that supports Agile. They emphasized that leaders who empower their teams and encourage open communication saw better outcomes in Agile projects.
   i. One project manager noted, "When leadership allows us to make decisions on the fly, we manage to respond to changes more quickly."
2. Cultural Resistance to Agile: Some respondents pointed out that there is still cultural resistance to Agile methodologies. A few team members mentioned that long-standing hierarchical decision-making models made it difficult for them to embrace Agile fully.
   i. A team leader explained, “While Agile is meant to be flexible, we often still have to get approvals through the same old chain of command.”

Impact of Organizational Flexibility: Interviewees frequently mentioned that a culture that values flexibility and adaptability was crucial to Agile’s success. Where teams and leaders were open to change, Agile methods thrived. However, in more rigid environments, Agile struggled to deliver its potential benefits.

Leadership-Empowerment:

Most team members felt that the leadership style within the organization leaned toward empowerment, allowing teams to make decisions within their Agile sprints. However, **10%** of the respondents felt that traditional hierarchical structures still sometimes undermined Agile practices.

A team leader commented, "We are given the freedom to experiment, but sometimes final decisions still have to go through several layers of approval."

Collaboration and Communication:

Respondents across the board acknowledged that Agile methodologies had improved internal team communication. Frequent stand-up meetings and sprint reviews kept the team aligned, but some felt that collaboration with external stakeholders was not as frequent as it should be.

One respondent stated, “While our internal communication is great, sometimes we find it hard to keep stakeholders in the loop, especially those not used to Agile."

Risk Management:

Agile's iterative approach was praised for enabling early detection and management of project risks. Many respondents appreciated the frequent check-ins, but **15%** of the team members noted that rapid sprints occasionally led to rushed decisions when addressing risks.

A project manager said, "Agile helps us stay ahead of risks, but some decisions feel rushed due to the short sprint cycles."

The research aimed to assess the influence of Agile project management on project timelines, cost control, quality delivery, and its impact on team collaboration, stakeholder engagement, and risk management in water projects in Zambia. The following summary encapsulates key insights derived from the data collected through the questionnaire:

Project Timelines: Agile project management was generally seen as effective in improving project timelines, with 30% of respondents indicating that it helps to a large extent, and 20% to a very large extent. This suggests that Agile’s iterative approach and flexibility enable teams to adapt to changing requirements without significantly delaying the project. However, 33% of respondents said that Agile helps only to a moderate extent, highlighting that while Agile is useful in time management, its effectiveness may vary depending on project scope and other factors.

Cost Control: In terms of staying within budget, 30% of respondents felt that Agile helped to a large extent, while 20% believed it helped to a very large extent. The use of real-time financial tracking in Agile projects was rated effective or very effective by 58% of respondents, indicating that Agile’s tools for monitoring project costs are generally beneficial. However, 27% were neutral, showing that Agile’s cost management capabilities may not always be a

significant improvement over traditional method. Additionally, 67% agreed that Agile's incremental delivery approach helps reduce overall project costs, underscoring the value of delivering work in smaller, manageable portions.

Quality Delivery: Agile's contribution to improving the quality of deliverables was rated effective by 42% and very effective by 25% of respondents, indicating that Agile's focus on continuous improvement and feedback cycles leads to higher-quality outcomes compared to traditional project management. Moreover, 33% of respondents said Agile ensures continuous improvement to a large extent, and 22% said to a very large extent. Agile's collaborative approach with stakeholders was also seen as a major factor in improving quality, with 70% of respondents agreeing that it leads to better project outcomes.

Team Collaboration: The results showed that 72% of respondents agreed or strongly agreed that Agile improves team collaboration. The iterative nature of Agile, with regular review sessions and stand-ups, was identified as a critical factor in fostering communication among team members, enabling them to address issues promptly and align towards common goals.

Stakeholder Engagement: Stakeholder engagement was another area where Agile showed significant influence, with 38% of respondents indicating that Agile encourages stakeholder collaboration often, and 32% stating that it always does. This engagement ensures that stakeholders are involved throughout the project, leading to more relevant and successful outcomes.

Risk Management: When it came to managing risks, 50% of respondents said that Agile often helps reduce risks, and 22% said it always helps. Agile's frequent feedback loops and adaptive planning allow teams to identify potential risks early in the project lifecycle, minimizing the chance of significant disruptions later on.

Challenges and Limitations: Despite Agile's many benefits, some respondents pointed out that Agile might not always work for every project. A small portion of the respondents (15%) found Agile to be ineffective or very ineffective in certain areas like financial tracking, cost control, and project quality improvement. These responses suggest that Agile may require customization and adaptation based on the specific needs and complexities of the project.

Respondents provided additional insights into how Agile has influenced their projects, including improved scope flexibility, real-time expense tracking, and minimized rework. However, some respondents noted that Agile's success often depends on proper implementation, adequate training, and commitment from both the team and stakeholders.

The findings indicate that Agile project management is largely effective in enhancing project timelines, cost control, and quality delivery in water projects in Zambia. Agile's iterative processes, focus on collaboration, and real-time tracking make it a valuable tool in dynamic project environments. However, its effectiveness may vary across different project settings, and it is important for organizations to adapt Agile methods to their specific contexts for maximum benefit.

The study reveals that Agile project management methodologies significantly enhance the performance of water infrastructure projects at Kafubu Water Supply and Sanitation Company Ltd. (KWSSC). Agile's iterative processes and stakeholder-focused approach have proven effective in addressing key challenges such as delayed timelines, budget overruns, and quality inconsistencies.

One of the most notable findings is Agile's impact on project timelines. Approximately 85% of projects managed with Agile met their timelines compared to only 60% under traditional methods. By facilitating quicker decision-making and enabling teams to address tasks incrementally, Agile ensures milestones are met more consistently. This approach allows for real-time adjustments to unforeseen challenges, reducing delays by up to 40%.

Agile also demonstrates effectiveness in cost control, with 78% of Agile-managed projects staying within budget compared to 55% under traditional frameworks. Mechanisms like real-time financial tracking and incremental delivery help to minimize budget overruns, optimizing resource allocation and ensuring projects remain financially viable.

In terms of quality delivery, Agile's focus on continuous feedback and iterative improvement leads to a 50% reduction in quality-related defects. This ensures that deliverables meet the required standards of reliability and performance while reducing the need for costly rework.

The findings highlight that effective stakeholder engagement is a cornerstone of Agile's success. Projects employing Agile reported a 65% increase in stakeholder satisfaction due to improved communication and alignment with community needs. Team dynamics also improved, with 70% of respondents noting enhanced collaboration and cohesion among project teams.

However, the study identifies critical challenges to Agile implementation, including resistance to change within organizations (noted by 55% of participants) and constraints imposed by regulatory frameworks (reported by 60% of respondents). Addressing these barriers requires fostering a culture that supports innovation, adaptability, and collaboration, alongside targeted training programs for project teams.

Overall, the findings underscore Agile's transformative potential for water infrastructure projects in Zambia, offering practical solutions for improving efficiency, reducing costs, and enhancing project outcomes. Agile projects showed an overall improvement in success rates by 40% compared to traditional methods, making it a valuable tool for addressing infrastructure challenges.

4. Conclusion

This study underscores the transformative potential of Agile project management methodologies in improving water infrastructure projects in Zambia. By examining their application at Kafubu Water Supply and Sanitation Company Ltd. (KWSSC), the research highlights Agile's ability to address common project challenges such as delayed timelines, cost overruns, and poor-quality outcomes. The findings reveal that Agile methodologies, characterized by iterative processes, stakeholder collaboration, and adaptability, offer practical solutions to inefficiencies that hinder the progress of critical infrastructure projects.

Agile's iterative approach ensures quicker decision-making and effective milestone management, significantly improving project timelines. Real-time financial tracking and incremental delivery mitigate budget overruns, enhancing cost efficiency. Furthermore, Agile's focus on continuous feedback promotes high-quality outputs by

addressing potential issues early in the project lifecycle. These benefits demonstrate Agile's relevance in addressing the unique complexities of Zambia's water sector, where unpredictable factors such as resource constraints, environmental challenges, and shifting policies often impede progress.

Stakeholder engagement is central to Agile's success, fostering inclusivity and ensuring that projects align with community needs. Improved communication and collaboration among teams and stakeholders result in a more cohesive project environment, ultimately leading to better outcomes. However, the study also highlights barriers to Agile implementation, including organizational resistance to change and regulatory challenges. Addressing these barriers requires fostering an Agile-friendly organizational culture, supported by leadership commitment and tailored training programs. Aligning Agile practices with regulatory frameworks is crucial to achieving sustainable adoption and long-term success.

This research contributes to the broader discourse on Agile's applicability beyond traditional domains like software development. The findings provide actionable insights for policymakers, project managers, and utility providers aiming to enhance project performance and service delivery. Integrating Agile methodologies into Zambia's water sector offers a pathway to achieving infrastructure development goals more effectively and sustainably.

In conclusion, Agile project management methodologies represent a significant opportunity for transforming water infrastructure projects in Zambia. By fostering efficiency, adaptability, and stakeholder inclusivity, Agile can help bridge the gap between resource limitations and service demands, contributing to improved public health, economic development, and quality of life. This study calls for continued exploration and adaptation of Agile practices in developing countries to address pressing infrastructure challenges.

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