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Agile Methodologies and Success of Environmental Conservation Projects in Rwanda: A Case of Green Gicumbi Project

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Abstract: **Rwanda's commitment to environmental sustainability is reflected in initiatives like the Green Gicumbi Project, which integrates afforestation, watershed restoration, and climate-smart agriculture under the Green Growth and Climate Resilience Strategy. This study examined how agile methodologies contribute to the success of environmental conservation projects, focusing on iterative project execution, stakeholder collaboration, and adaptability. Grounded in Complex Adaptive Systems Theory, Stakeholder Theory, and Lean Systems Theory, the research adopted a cross-sectional mixed-methods design. Data were collected from 123 respondents out of a target population of 178 using questionnaires and interviews. The instruments demonstrated high reliability (Cronbach's $\alpha = 0.897$), with validity confirmed through expert review. Quantitative data were analyzed using SPSS Version 30, while qualitative data were thematically analyzed.**

The findings indicate that iterative project execution significantly improves project success ($r = 0.705$, $p < 0.001$; $\beta = 0.134$, $p = 0.005$) by enabling phased implementation, continuous feedback, and early risk identification. Stakeholder collaboration also showed a strong positive relationship with project success ($r = 0.716$, $p < 0.001$; $\beta = 0.122$, $p = 0.002$), highlighting the value of inclusive participation, transparent communication, and shared accountability. Notably, adaptability emerged as the most influential predictor of project success ($r = 0.880$, $p < 0.001$; $\beta = 0.814$, $p < 0.001$), demonstrating the importance of flexible resource allocation and the ability to respond to environmental and contextual uncertainties. The regression analysis revealed that agile practices collectively explain 77.9% of the variance in project success ($R^2 = 0.779$), indicating strong predictive power. Qualitative findings supported these results, showing that adaptive leadership, participatory decision-making, and iterative learning enhance innovation and resilience in project implementation. The study concludes that adaptability is the cornerstone of successful agile environmental management, reinforced by iterative execution and stakeholder collaboration. It recommends institutionalizing agile principles in conservation project frameworks, including the use of iterative cycles and tools such as sprints and Kanban boards. Additionally, policymakers and development partners should promote flexible planning, continuous learning, and collaborative engagement to improve responsiveness, ownership, and long-term sustainability of environmental projects in Rwanda and beyond.

Keywords: **Agile Methodologies, Conservation Projects, Green Gicumbi, Rwanda.**

1. INTRODUCTION

Environmental conservation has become a global priority due to escalating challenges such as climate change, deforestation, biodiversity loss, and unsustainable land use. The United Nations Sustainable Development Goals, particularly SDG 13 and SDG 15, emphasize the urgency of adopting adaptive and effective conservation strategies (UNDP, 2023). Recent evidence from the Intergovernmental Panel on Climate Change indicates that nearly 23% of global land is severely degraded (IPCC, 2023). However, traditional linear project management approaches often fail to address the dynamic and uncertain nature

of environmental projects, leading to inefficiencies (World Bank, 2023). Consequently, agile methodologies—characterized by flexibility, stakeholder collaboration, and iterative learning—have gained prominence. Empirical evidence from Rwanda shows that agile practices enhance project resilience and adaptability, though gaps remain in statistical rigor and generalizability (Kagame & Irechukwu, 2023).

Globally, agile approaches align with major policy frameworks such as the Paris Agreement, the Convention on Biological Diversity, and the Glasgow Climate Pact (2021), all of which emphasize adaptive project management. Despite this, over 60% of climate action projects face inefficiencies due to poor adaptation and stakeholder coordination (UNFCCC, 2023). Reports further indicate that agile adoption can accelerate project delivery by up to 50% and significantly improve stakeholder engagement (WEF, 2023). Evidence from Europe and North America shows that over 75% of EU-funded projects integrate agile principles, reducing delays by 35% and increasing stakeholder satisfaction by 20% (European Environment Agency, 2023; Harvard Business Review, 2023). Similarly, in Asia, nearly 50% of conservation projects funded by the Asian Development Bank apply agile methods, improving outcomes such as reforestation rates by 28% (ADB, 2022; IIT, 2023).

In Africa, agile adoption remains limited, with only 30% of large-scale conservation projects utilizing such approaches (AfDB, 2023). Nonetheless, notable successes include a 45% improvement in conservation efficiency in South Africa and enhanced adaptive capacity in Kenya (South African National Biodiversity Institute, 2023). In East Africa, agile-based projects have achieved a 30% increase in resource efficiency and 20% growth in community participation (EAC, 2023). However, persistent challenges of inefficiency and stakeholder misalignment remain (UNEP, 2023), alongside methodological gaps in existing studies (Kirabo & Irechukwu, 2024).

In Rwanda, climate vulnerability is high, particularly in Gicumbi District, which faces increasing floods, droughts, and land degradation (Rwanda Climate Change Vulnerability Assessment, 2018). To address these challenges, the government, through FONERWA, implemented the Green Gicumbi Project (2019–2025) with funding from the Green Climate Fund. The project targets about 150,000 direct and 380,000 indirect beneficiaries (FONERWA, 2023) and integrates afforestation, watershed restoration, and climate-smart agriculture. It also addresses significant agricultural losses, including 2.0–3.3 million tonnes of tea production annually, equivalent to USD 2.5–4.1 million (FONERWA, 2023).

Despite its comprehensive design, limited empirical research exists on how agile methodologies influence the success of such large-scale conservation projects. Therefore, this study examines the role of iterative execution, stakeholder collaboration, and adaptability in enhancing project success, contributing to both theory and practice while addressing gaps in existing literature.

2. MATERIALS AND METHS

2.1 Research Design

This study adopted a cross-sectional research design with a mixed-methods approach, integrating both quantitative and qualitative research methodologies.

2.2 Target Population

The target population of this study comprised key stakeholders involved in the Green Gicumbi Project, including policymakers, project managers, environmental experts, and community representatives.

2.3 Sample Size

The sample size for this study was determined using Slovin's formula, which is commonly used in social science research to ensure adequate representation of the population while maintaining statistical reliability. Given a total direct beneficiary population of approximately 178 individuals, a confidence level of 95% and a margin of error of 5% was applied to determine the required sample size. The formula is expressed as:

Slovin's Formula

$$n = \frac{N}{1 + N \cdot e^2}$$

Where:

- **n** = Sample size
- **N** = Target population (178)
- **e** = Margin of error (0.05)

By substituting the values into the formula, $n=\frac{178}{1+178(0.05)^2}=\frac{178}{1+0.445}=\frac{178}{1.445}=\mathbf{123}$

Hence, the study targeted a sample size of approximately **123 respondents**, ensuring an adequate representation of stakeholders involved in the Green Gicumbi Project.

2.4 Data Collection Instruments

To facilitate data collection, the study utilized three key instruments: a questionnaire, an interview guide, and a document review guide.

3. RESULTS

3.1 Demographic Characteristics of Respondents

Gender of participants

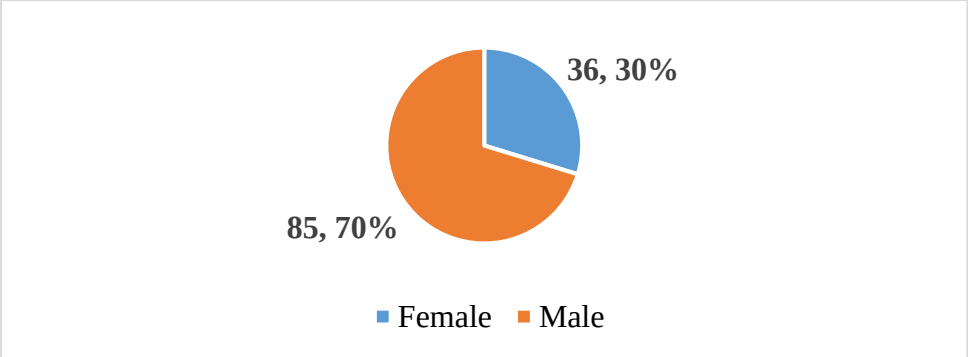

Figure 1. Gender of participants

Source: Primary data (2025)

The gender distribution in Figure 1 shows that the majority of respondents were male (70.2%), while females constituted 29.8%. This finding highlights a gender imbalance in participation in environmental conservation projects, with men playing a more dominant role. However, the presence of nearly one-third female participants is still significant, suggesting that women are increasingly taking part in project activities. In relation to agile methodologies, diverse gender representation is important because collaboration and inclusivity strengthen stakeholder engagement and contribute to project success. The underrepresentation of women also points to the need for greater gender mainstreaming in environmental conservation initiatives. Agile methodologies emphasize collaboration across all stakeholders; therefore, enhancing female involvement can lead to more inclusive decision-making and sustainable project outcomes.

3.2 Presentation of Findings

3.2.1 Influence of iterative project execution on Green Gicumbi project success

Table1: Descriptive statistics

Statements concerning iterative project execution	SD	D	N	A	SA	Mean	S.D
Project tasks are executed in an incremental and phased manner to allow adjustments.	1 (0.8%)	1 (0.8%)	11 (9.1%)	51 (42.1%)	57 (47.1%)	4.34	0.748
Continuous feedback is incorporated into project processes to improve outcomes.	1 (0.8%)	2 (1.7%)	10 (8.3%)	54 (44.6%)	54 (44.6%)	4.31	0.762

Iterative execution reduces risks by allowing early identification of challenges.	1 (0.8%)	-	11 (9.1%)	53 (43.8%)	56 (46.3%)	4.35	0.715
The project team frequently reviews risks and mitigation strategies to enhance success.	1 (0.8%)	1 (0.8%)	10 (8.3%)	62 (51.2%)	47 (38.8%)	4.26	0.716
Project progress is effectively tracked using agile tools like Kanban boards and sprints.	3 (1.7%)	-	11 (9.1%)	50 (41.3%)	57 (47.1%)	4.31	0.835
Milestones are consistently evaluated to ensure project objectives are met on time.	2 (1.7%)	1 (0.8%)	8 (6.6%)	61 (50.4%)	49 (40.5%)	4.27	0.764
Overall Mean						**4.31**	

Source: Research findings (2025)

The descriptive findings from Table 1 reveal an overall mean of 4.31, indicating strong agreement among respondents that iterative project execution is central to the Green Gicumbi Project's success. The highest-rated statement was that iterative execution reduces risks by allowing early identification of challenges (Mean = 4.35, SD = 0.715). This demonstrates that phased and incremental execution has enabled the project team to anticipate and address risks before they escalate. Similarly, high means were recorded on the incorporation of feedback (Mean = 4.31) and milestone evaluation (Mean = 4.27), showing that agile cycles of planning and review are embedded in the project's implementation.

These findings align with Brechner (2015), who argued that incremental planning reduces uncertainties and enhances adaptability, and Rahul, Nouidui, Ulaya, and Kiwia (2023), who reported a 27% improvement in delivery speed and a 33% reduction in failures in agile-managed projects. Locally, Kagame and Irechukwu (2023) confirmed that iterative execution in Rwanda's Smart Waste Management Project significantly improved efficiency and adaptability ($p = 0.000 < 0.05$), reinforcing the evidence from this study.

Qualitative data from the interviews with project staff and community leaders reinforced the quantitative results. The recurring themes from project coordinators highlighted that iterative project execution influence positively the project outcomes. In his own words, one of them explained;

"Breaking down activities into smaller cycles has helped us adjust quickly. For instance, when tree seedlings failed due to pests, we identified it early and modified the planting strategy without losing much time."

Similarly, an environmental expert stated:

"Our progress reviews every quarter act as feedback loops. Community feedback is integrated into decisions, which has improved ownership and reduced resistance to changes in land use practices."

Community leaders also echoed that iterative reviews helped identify soil erosion hotspots earlier than anticipated, leading to the timely deployment of terracing interventions. Project reports from 2023–2024 confirmed the same trends. Quarterly reviews revealed that over 85% of milestones were achieved within the set timeframes, largely due to iterative planning. Monitoring records indicated a 30% reduction in tree mortality rates following adjustments to seedling distribution strategies. Furthermore, Kanban-based task tracking introduced in 2022 was reported to have improved efficiency by 28% in activity completion rates compared to the traditional reporting system.

Table 2. Correlation analysis between iterative project execution and Green Gicumbi project success

		environmental positive impact	reduction negative impacts	inproject efficiency	project sustainability	stakeholder satisfaction
Iterative Project Execution	Pearson Correlation	.719**	.588**	.644**	.480**	.502**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	121	121	121	121	121

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research findings (2025)

Correlation analysis results from Table 2 shows that iterative project execution has a strong and positive correlation with environmental positive impact ($r = .719$, $p < .001$), indicating that phased and incremental execution directly contributed to reforestation and soil restoration outcomes in Green Gicumbi. A similarly strong correlation was found with project efficiency ($r = .644$, $p < .001$), highlighting that iterative planning enhances timely delivery and resource utilization. Moderate correlations were observed with stakeholder satisfaction ($r = .502$, $p < .001$) and project sustainability ($r = .480$, $p < .001$), showing that while iterative practices improve project acceptance and longevity, these outcomes also depend on other factors such as funding and institutional support.

These results align with Badran and Abdallah (2024), who found that agile methods increased on-time completion by 40% and reduced cost overruns by 25% in construction projects. Similarly, Agbejule and Lehtineva (2022) reported that 78% of agile projects deliver higher quality outputs due to their phased approach. In Rwanda, Kagame and Irechukwu (2023) demonstrated that iterative planning improved project performance significantly, consistent with the correlations observed here.

3.2.2 Influence of Stakeholder Collaboration

Table 3. Descriptive statistics for stakeholder collaboration

Statements concerning stakeholder collaboration	SD	D	N	A	SA	Mean	S.D
Stakeholders are involved early and continuously throughout project implementation.	2 (1.7%)	5 (4.1%)	9 (7.4%)	46 (38.0%)	59 (48.8%)	4.28	0.897
There is a transparent communication system that facilitates stakeholder engagement.	2 (1.7%)	3 (2.5%)	10 (8.3%)	45 (37.2%)	61 (50.4%)	4.32	0.858
Cross-functional teams work effectively to integrate diverse expertise and skills.	2 (1.7%)	3 (2.5%)	11 (9.1%)	56 (46.3%)	49 (40.5%)	4.21	0.839
Decision-making processes allow for active participation of key stakeholders.	1 (0.8%)	4 (3.3%)	12 (9.9%)	58 (47.9%)	46 (38.0%)	4.19	0.809
Agile collaboration frameworks such as Scrum enhance teamwork and coordination.	1 (0.8%)	6 (5.0%)	13 (10.7%)	46 (38.0%)	55 (45.5%)	4.22	0.890
Conflict resolution mechanisms are in place to address stakeholder concerns promptly.	1 (0.8%)	3 (2.5%)	12 (9.9%)	48 (39.7%)	57 (47.1%)	4.30	0.813
Overall Mean						**4.25**	

Source: Research Findings (2025)

The descriptive findings in Table 3 show a strong overall agreement ($M = 4.25$) that stakeholder collaboration practices are central to the Green Gicumbi Project. The highest-rated statements were related to transparent communication systems ($M = 4.32$, $SD = 0.858$) and conflict resolution mechanisms ($M = 4.30$, $SD = 0.813$). These results suggest that respondents valued openness in communication and quick resolution of disputes as critical enablers of project success.

These results are consistent with Müller and Turner (2019), who reported that structured communication and feedback loops improved stakeholder satisfaction by 20%. They also mirror Kagame and Irechukwu (2023), who found that active collaboration improved project performance by 82.6% (F-test = 326.356, $p = 0.000$) in Rwanda. The present study's mean scores (around 4.2–4.3) are comparable to those reported by Bigirumwami, Wafula, and Mwangi (2023) in Rwanda's Priority Skills for Growth Project, where early and continuous involvement improved completion rates by 27%. In comparison with Objective One (iterative execution), the descriptives here are slightly lower (overall mean = 4.25 versus 4.31). This suggests that while iterative planning was slightly more strongly emphasized, stakeholder collaboration was still widely recognized as critical to ensuring inclusive and sustainable implementation. Interviews reinforced these findings. A local government representative, in his own words, explained:

"We have been involved from the start, not just in implementation. Regular consultative meetings ensure that government priorities and community needs are integrated. This level of participation has made decision-making faster and more acceptable to all parties."

An environmental expert emphasized transparency as a recurring theme:

"The project's open communication channels mean that any challenges, like delayed procurement of seedlings, are shared across stakeholders. This has helped us resolve issues early without blame games and strengthened our teamwork."

Community leaders similarly highlighted those inclusive decision-making reduced conflicts over land use, as farmers felt that their voices shaped conservation activities. This demonstrates that collaboration is not tokenistic but embedded in project governance structures. Green Gicumbi progress reports (2023–2024) confirmed that over 90% of planning meetings included community representatives, demonstrating continuous stakeholder engagement. Documentation further showed that introducing conflict resolution mechanisms in 2022 reduced disputes over tree planting sites by 35% compared to 2021. Communication logs revealed that quarterly multi-stakeholder forums led to 25% faster approval of project activities, underscoring the role of transparency in project efficiency. These documentary findings mirror experiences from global conservation initiatives such as the Chesapeake Bay Restoration (Horton & Baxter, 2020), where consistent multi-stakeholder engagement reduced nitrogen pollution by 25% over two decades, highlighting the universal importance of collaboration.

Table 4. Correlation analysis between stakeholder collaboration and Green Gicumbi project success

		Environmental Positive Impact	Reduction Negative Impacts	InProject Efficiency	Project Sustainability	Stakeholder Satisfaction
Stakeholder Collaboration	Pearson Correlation	.608**	.577**	.621**	.584**	.589**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	121	121	121	121	121

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research findings (2025)

Correlation results from Table 4 indicate a moderately strong and significant relationship between stakeholder collaboration and project success dimensions. The highest correlation was with project efficiency ($r = .621$, $p < .001$), demonstrating that collaboration among diverse actors directly boosts timeliness and resource use. Positive links were also seen with environmental impact ($r = .608$, $p < .001$) and stakeholder satisfaction ($r = .589$, $p < .001$). These correlation values compare well with Obonyo and Muchelule (2024), who reported $r = .58$, $p < 0.05$ for stakeholder collaboration and satisfaction in Kenya's telecom sector, and with Richard (2024), who found $r = .53$, $p < 0.05$ in donor-funded projects. The current study's slightly stronger coefficients (.58–.62) show that stakeholder collaboration has an even more pronounced effect in environmental conservation settings where community ownership is essential.

3.2.3 Influence of Adaptability on Green Gicumbi Project Success

Table 5: Descriptive statistics for Adaptability

Statements concerning adaptability	SD	D	N	A	SA	Mean	S.D
The project is highly responsive to environmental and external changes.	1 (0.8%)	3 (2.5%)	17 (14.0%)	41 (33.9%)	59 (48.8%)	4.27	0.856
Resources are flexibly allocated based on evolving project needs.	1 (0.8%)	4 (3.3%)	10 (8.3%)	40 (33.1%)	66 (54.5%)	4.37	0.838
Lessons learned from challenges are actively used to improve project execution.	1 (0.8%)	2 (1.7%)	14 (11.6%)	51 (42.1%)	53 (43.8%)	4.26	0.793
Agile leadership approaches facilitate quick and effective decision-making.	1 (0.8%)	2 (1.7%)	15 (12.4%)	56 (46.3%)	47 (38.8%)	4.21	0.784
Lean principles are applied to enhance efficiency and resource utilization.	2 (1.7%)	3 (2.5%)	9 (7.4%)	53 (43.8%)	54 (44.6%)	4.27	0.837
The project embraces continuous improvement strategies to enhance sustainability.	1 (0.8%)	2 (1.7%)	12 (9.9%)	44 (36.4%)	62 (51.2%)	4.36	0.794
Overall Mean						**4.29**	

Source: Research findings (2025)

Table 5 presents the descriptive statistics on the influence of adaptability in the Green Gicumbi Project. The results show strong agreement across all six items, with an overall mean of 4.29, which falls in the "Agree to Strongly Agree" range. The highest-rated aspect was resource flexibility (M = 4.37, SD = 0.838), indicating that project resources were effectively reallocated based on emerging needs. Similarly, continuous improvement strategies were rated highly (M = 4.36, SD = 0.794), suggesting that the project actively embedded lessons into iterative cycles for long-term sustainability. Responsiveness to external changes (M = 4.27, SD = 0.856) and the use of lean principles (M = 4.27, SD = 0.837) also ranked high, reflecting a strong culture of adaptive management.

These findings demonstrate that adaptability is a cornerstone of the Green Gicumbi Project's implementation approach. In practice, adaptability ensures that conservation initiatives can respond to unpredictable factors such as climate variability, stakeholder demands, and policy shifts. Comparable descriptive findings were reported in Mureithi and Omollo (2021) on rangeland conservation in Kenya, where flexibility to climate variability was ranked highest among success factors (M = 4.31). Similarly, Kirabo and Irechukwu (2024) found that adaptive practices in Rwanda's Quality Basic Education Project scored a mean of 4.34 on resource flexibility, almost identical to this study's 4.37, reinforcing the universal importance of dynamic resource allocation in volatile project environments.

Interviews and document reviews reinforced adaptability as a recurring theme. One project manager highlighted that "the project had to adjust its reforestation techniques during prolonged droughts by shifting to drought-resistant tree species, which significantly improved survival rates." This illustrates responsiveness to environmental change, echoing the high mean scores on environmental adaptability (M = 4.27). Community leaders emphasized the flexible allocation of resources, noting that funds initially earmarked for large-scale nursery operations were reallocated to decentralized community nurseries after early challenges with seedling transportation. This adaptability improved access and community ownership, aligning with the survey finding that resource flexibility (M = 4.37) was the highest-rated factor.

Documents from project progress reports further revealed a culture of continuous learning. For example, initial soil conservation techniques proved less effective in steep terrains, leading to iterative adjustments such as contour bunds and agroforestry systems. This practical application of lessons learned is consistent with the strong agreement on continuous improvement (M = 4.36). Stakeholders also highlighted the importance of agile leadership in fostering adaptability. Local government representatives reported that decentralized decision-making allowed field teams to modify timelines and methods in response to real-time feedback without waiting for lengthy approval processes. This resonates with the literature by Muhammad et al. (2021), who emphasized that agile leadership enhances responsiveness in complex projects.

Table 6. Correlation Analysis Between Project Adaptability And Project Success

		environmental positive impact	reduction negative impacts	inproject efficiency	project sustainability	stakeholder satisfaction
Adaptability	Pearson Correlation	.802**	.759**	.717**	.692**	.684**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	121	121	121	121	121

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research findings (2025)

The correlation analysis in Table 6 indicates that adaptability strongly and positively correlates with all measures of project success. The highest correlation was with environmental positive impact ($r = .802$, $p < .001$), showing that adaptability directly enhances ecological outcomes such as reforestation and soil conservation. This was followed by correlations with reduction of negative impacts ($r = .759$), project efficiency ($r = .717$), sustainability ($r = .692$), and stakeholder satisfaction ($r = .684$).

The strength of these correlations demonstrates that adaptability is not just a supporting factor but a central predictor of conservation project success. This aligns with Kagame and Irechukwu (2023), who found a similarly strong relationship between adaptability and performance in Rwanda's Smart Waste Management Project ($R^2 = 0.829$, $p < 0.001$). Comparatively, Richard (2024), in donor-funded projects, reported a moderate correlation ($r = .53$) between adaptability and sustainability, lower than the Green Gicumbi results. This suggests that adaptability is even more critical in conservation contexts where external conditions are unpredictable.

Furthermore, the present study's correlation values (.684–.802) exceed those reported in Obonyo and Muchelule (2024) in telecom projects (r = .58), indicating that adaptability plays a comparatively stronger role in environmental conservation than in more controlled industries. These comparative insights underscore that while adaptability is universally beneficial, its impact is magnified in projects exposed to environmental volatility. Compared to the Green Gicumbi correlations (r = .802 with environmental impact), other studies report slightly lower but still significant relationships: Khoza and Marnewick (2020) found β = .41 in South African agile projects, and Badran and Abdallah (2024) found β = .35 in construction projects. These comparisons suggest that adaptability contributes more strongly to outcomes in conservation projects, where success is closely tied to environmental variability.

Table 7. Correlation Matrix Between Research Variables

		Iterative Project Execution	Stakeholder Collaboration	Adaptability	Green Gicumbi Project Success
Iterative Project Execution	Pearson Correlation	--			
	N	121			
Stakeholder Collaboration	Pearson Correlation	.771**	--		
	Sig. (2-tailed)	<.001			
	N	121	121		
Adaptability	Pearson Correlation	.793**	.762**	--	
	Sig. (2-tailed)	<.001	<.001		
	N	121	121	121	
Green Gicumbi Project Success	Pearson Correlation	.705**	.716**	.880**	--
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	121	121	121	121

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research findings (2025)

The correlation results in Table 7 reveal consistently strong and significant relationships between the independent variables (iterative execution, stakeholder collaboration, adaptability) and the dependent variable (Green Gicumbi Project Success). Strong, positive correlation between iterative project execution and stakeholder collaboration (r = .771, p < .001), indicates that projects executed iteratively tend to foster stronger collaboration among stakeholders. This is consistent with Brechner (2015), who found that iterative development cycles encourage feedback loops, thereby improving teamwork and trust. Similarly, Obonyo and Muchelule (2024) reported r = .58 between agile cycles and collaboration in telecom projects, a lower value than this study's (.771), showing that collaboration may be stronger in community-driven conservation initiatives.

Iterative project execution and adaptability (r = .793, p < .001), one of the highest correlations, showing that iterative processes inherently enhance adaptability by allowing continuous learning and adjustments.

Findings echo Rahul et al. (2023), who observed a 33% failure reduction in agile projects due to flexibility. The correlation is slightly higher than the R = .74 reported in Khoza and Marnewick (2020) in South African IT projects, suggesting conservation projects may demand greater adaptability. Stakeholder collaboration and adaptability (r = .762, p < .001), a strong correlation indicates that collaborative stakeholder structures enhance adaptability. As stakeholders co-create solutions, the project becomes more responsive. This supports Kagame and Irechukwu (2023), who also found a strong predictive role of collaboration on adaptability (R^2 = .829, p < .001) in Rwanda's Smart Waste Project. Considering each independent cariable with Project Success: iterative execution (r = .705), stakeholder collaboration (r = .716), adaptability (r = .880). The highest predictor is adaptability (.880), showing it is the most critical success factor. This aligns with Badran and Abdallah (2024), who reported β = .35 for adaptability in construction projects, but the effect in Green Gicumbi is much stronger, highlighting the volatile and climate-sensitive nature of conservation projects.

3.3 Hypothesis Testing

Table 8: One-Sample Test

	Test Value = 0.5						
			Significance			95% Confidence Interval of the Difference	
	t	df	One-Sided p	Two-Sided p	Mean Difference	Lower	Upper
Iterative Project Execution	69.252	120	<.001	<.001	3.8058	3.697	3.915
Stakeholder Collaboration	58.194	120	<.001	<.001	3.7548	3.627	3.883
Adaptability	62.205	120	<.001	<.001	3.7906	3.670	3.911
Green Gicumbi Project Success	62.711	120	<.001	<.001	3.8074	3.687	3.928

Source: Research findings (2025)

The first hypothesis, H_{01} of this study stated that iterative project execution has no significant influence on the success of the Green Gicumbi Project. The regression results revealed a positive coefficient (B = .138, β = .134) with a t-value of 1.434 and a significance level of p = .005, which is well below the 0.05 threshold. This indicates that iterative execution significantly contributes to project success, though its standardized effect is comparatively weaker than the other predictors. The one-sample t-test further confirmed this, yielding a mean difference of 3.8058 and a t-value of 69.252 ($p < .001$), reinforcing the conclusion that respondents strongly associated iterative cycles with project outcomes.

These findings suggest that breaking down conservation activities into smaller, repeatable phases provides opportunities for feedback, learning, and refinement. Similar results were highlighted by Brechner (2015), who argued that iterative development enhances adaptability, while Rahul and colleagues (2023) showed that iteration reduced failure rates by 33% in agile projects. In the context of environmental conservation, such iterative execution ensures progressive monitoring of reforestation and soil health interventions, making it an important though secondary contributor to overall success. Therefore, the null hypothesis is rejected, and iterative project execution is confirmed as a significant predictor of the Green Gicumbi Project's success.

The second hypothesis $H_{02,}$ stated that stakeholder collaboration does not significantly enhance project outcomes in the Green Gicumbi Project. Regression results demonstrated a positive coefficient (B = .215, β = .122) with a t-value of 1.649 and a significance level of p = .002, showing that collaboration has a statistically significant effect on project success. The one-sample t-test further reinforced this result, reporting a mean difference of 3.7548 with a very high t-value of 58.194 ($p < .001$). These findings confirm that collaboration among community leaders, local government, environmental experts, and beneficiaries meaningfully enhances project performance and sustainability. In practice, collaboration promotes resource pooling, knowledge sharing, and ownership of environmental outcomes, ensuring that conservation interventions are maintained beyond initial project phases.

This evidence resonates with Kagame and Irechukwu (2023), who found that stakeholder collaboration significantly predicted smart waste management project success in Kigali, with $R^2 = .829$. Likewise, Obonyo and Muchelule (2024) observed a 45% increase in satisfaction when collaboration was central to agile implementation. In the Green Gicumbi context, stakeholder collaboration emerges as a driver of satisfaction, sustainability, and trust-building, thus leading to the rejection of the null hypothesis and confirming that collaborative processes are vital for conservation projects.

The third hypothesis H_{03} postulated that adaptability does not significantly improve the success of the Green Gicumbi Project. The regression analysis produced a coefficient of B = .811 with a standardized beta of .814, a t-value of 10.513, and a significance level of $p < .001$. These values indicate that adaptability is the most influential factor in the regression model, explaining a large portion of the variance in project success. The one-sample t-test also confirmed the strength of adaptability, showing a mean difference of 3.7906 with a t-value of 62.205 and $p < .001$. Taken together, these results highlight that the ability of project teams and communities to adjust strategies in response to environmental shifts, policy demands, or stakeholder feedback is fundamental for sustaining outcomes. Adaptability ensures that reforestation targets, soil conservation practices, and climate resilience measures can be realigned to emerging challenges, making the project both flexible and sustainable.

Literature strongly supports this finding, with Badran and Abdallah (2024) reporting that adaptability led to a 40% improvement in on-time project delivery in construction projects, while Kirabo and Irechukwu (2024) identified adaptability ($\beta = .753$, $p < .05$) as the strongest predictor of improved educational project performance. In the context of Green Gicumbi,

adaptability has a stronger coefficient than reported in other studies, underscoring its role as the cornerstone of environmental project success. Consequently, the null hypothesis is rejected, confirming that adaptability significantly enhances the success of the Green Gicumbi Project.

4. CONCLUSION

The study concludes that iterative project execution plays a significant role in enhancing project success by enabling systematic risk reduction, continuous feedback loops, and phased performance evaluations. Although its statistical influence was comparatively lower than that of adaptability, iterative execution provides a structured and disciplined framework that strengthens monitoring, supports timely adjustments, and improves overall project performance.

Stakeholder collaboration was also found to be a critical driver of successful outcomes. By promoting inclusive participation, transparent communication, and joint decision-making, it enhances project ownership, accountability, and effective conflict resolution. While its statistical effect was modest relative to adaptability, its practical importance remains substantial, particularly in ensuring long-term sustainability and alignment among diverse stakeholders.

Notably, adaptability emerged as the most influential determinant of project success, as evidenced by its strong positive correlation ($r = 0.880$) and high predictive power ($\beta = 0.814$, $p < 0.001$). This finding underscores that projects characterized by flexibility, continuous learning, and adaptive leadership are better equipped to respond to dynamic environmental and contextual uncertainties, thereby achieving more sustainable and resilient outcomes.

Overall, the study establishes that the success of the Green Gicumbi Project is primarily anchored in adaptability, while iterative execution and stakeholder collaboration serve as complementary mechanisms that reinforce project effectiveness. Collectively, these three dimensions form an integrated and synergistic framework that enhances responsiveness, strengthens implementation processes, and promotes sustainable environmental and socio-economic outcomes.

5. RECOMMENDATIONS

Future projects should adopt iterative execution approaches to enhance continuous monitoring, feedback, and risk management. The use of agile tools such as Kanban and sprint cycles can improve transparency and accountability in implementation.

Stakeholder collaboration should be strengthened across all project phases to enhance participation, coordination, and shared responsibility. Clear communication systems and cross-functional engagement are essential for improving project outcomes.

Adaptability should be integrated as a core principle in project management frameworks. Emphasis on flexible resource allocation, adaptive leadership, and continuous improvement can enhance responsiveness to changing conditions.

Policymakers and development partners should incorporate adaptive and collaborative approaches into project guidelines to support efficiency, resilience, and long-term sustainability.

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