



Effect of Stakeholder Engagement on Success of a Community-Based Project: A Case of Volcano Belt Water Supply Project under WASH Program in Musanze District, Rwanda

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Abstract: This study assessed the role of Stakeholder Engagement on success of community-based projects in Rwanda: a case of Volcano Belt Water Supply Project under WASH Program in Musanze District. The study was anchored on stakeholder theory, participatory development theory, and systems theory. The target population consisted of 286 stakeholders involved in implementation and management of community-based WASH projects in Musanze District, including community beneficiaries, local leaders, WASH committee members, project staff, and development partners. A sample size of 167 respondents was determined using the Taro Yamane formula. Quantitative data were analyzed using descriptive statistics, correlation analysis, and regression analysis with the help of SPSS. The descriptive results showed favourable and homogeneous assessments for decision making (overall $M=4.157$, $SD=0.404$), planning and design ($M=4.241$, $SD=0.452$), implementation of actions ($M=4.157$, $SD=0.404$), monitoring and evaluation ($M=4.206$, $SD=0.414$), and project success ($M=4.157$, $SD=0.404$). Stakeholder involvement in decision making had a positive and statistically significant effect on project success ($B=0.292$, $t=4.787$, $p=0.000$); planning and design also made a statistically significant contribution ($B=0.202$, $t=3.885$, $p=0.000$); involvement in implementation actions strengthened project success ($B=0.242$, $t=3.408$, $p=0.001$); and monitoring and evaluation remained a statistically significant predictor ($B=0.197$, $t=3.031$, $p=0.003$). The combined model explained 83.7% of the variation in project success. The study concluded that community-based WASH projects benefited when stakeholders influenced decisions, shaped plans, supported implementation and participated in performance review. It recommended institutionalising documented participation arrangements across the complete project cycle.

Keywords: Stakeholder Engagement, Decision Making, Project Planning, Implementation, Monitoring and Evaluation, Community-Based Project Success, WASH.

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1. Introduction

Stakeholder engagement has become a critical factor in enhancing the success and sustainability of community-based projects, particularly in sectors related to water, sanitation, and hygiene (WASH). Community-based projects are designed to improve the welfare of local

populations through participatory development approaches that involve beneficiaries, government institutions, donors, civil society organizations, and private actors in project processes. Effective stakeholder engagement promotes collaboration, transparency, accountability, and shared ownership, which contribute significantly to project performance and sustainability (Freeman, 2022). The projects that actively involve

stakeholders in planning, implementation, monitoring, and evaluation are more likely to achieve intended outcomes and gain long-term community support. In the WASH sector, stakeholder engagement is increasingly recognized as essential for ensuring access to clean water, improved sanitation, and better hygiene practices, especially in developing countries where community participation determines project sustainability and functionality (Bryson, 2023).

Despite these policy commitments and notable investments in WASH infrastructure, including the implementation of the Volcano Belt Water Supply Project in Musanze District, several operational and sustainability challenges persist. Empirical observations and sector reports indicate that some community-based WASH projects continue to experience inadequate stakeholder coordination, limited community ownership, weak communication channels, and insufficient participation in post-implementation management. These challenges have contributed to cases of infrastructure deterioration, irregular maintenance of water systems, delayed problem reporting, and declining community engagement after project completion, thereby undermining long-term project sustainability and effectiveness (RURA, 2023).

Existing empirical studies further reveal mixed and context-specific findings on the relationship between stakeholder engagement and project success. For instance, Habimana and Nkurunziza (2023) found that inadequate communication and limited stakeholder involvement negatively affect the sustainability of WASH projects in Rwanda; however, their study focused largely on policy-level implementation without examining project-level dynamics in specific infrastructure projects. Similarly, Uwizeyimana and Mugisha (2022) established that beneficiary participation enhances project ownership and sustainability, but their analysis was not specific to WASH projects in Musanze District. Mutua (2023) demonstrated that stakeholder coordination improves water project performance in Kenya, although the study did not address sustainability outcomes within Rwanda's institutional framework.

Although these studies provide valuable insights, they reveal clear conceptual, contextual, and geographical gaps. Conceptually, many studies do not disaggregate stakeholder engagement into key dimensions such as participation, communication, collaboration, coordination, and monitoring and evaluation. Contextually, limited research has focused specifically on large-scale community-based WASH infrastructure projects such as the Volcano Belt Water Supply Project. Geographically, there is a scarcity of empirical evidence focusing on Musanze District, despite its strategic importance as a major water supply hub in Rwanda. Therefore, this study sought to assess the role of stakeholder engagement on the success of community-

based projects in Rwanda, with a specific focus on the Volcano Belt Water Supply Project under the WASH program in Musanze District.

1.1 General Objective

The general objective was to assess the role of stakeholder engagement in the success of community-based projects in Rwanda, with particular reference to the Volcano Belt Water Supply Project under the Water, Sanitation and Hygiene (WASH) Program in Musanze District.

1.2 Specific Objectives

- i. To assess the effect of stakeholder involvement in decision making on the success of the Volcano Belt Water Supply Project in Musanze District;
- ii. To examine the effect of stakeholder involvement in project planning and design on the success of the Volcano Belt Water Supply Project in Musanze District;
- iii. To analyze the effect of stakeholder involvement in implementation of actions in enhancing the sustainability of the Volcano Belt Water Supply Project in Musanze District;
- iv. To evaluate the effect of stakeholder involvement in monitoring and evaluation on the effectiveness and long-term success of the Volcano Belt Water Supply Project in Musanze District.

2. Literature Review

2.1 Theoretical Review

This section presented the theories that were useful to the study. Stakeholder Theory explained who should be engaged and why. Participatory Development Theory explained how stakeholders should participate. Systems Theory explained how stakeholder interactions and coordination collectively influenced project success. Together, the three theories provided a comprehensive theoretical foundation for examining the relationship between stakeholder engagement and the success of the Volcano Belt Water Supply Project in Musanze District.

2.1.1 Stakeholder Theory

Stakeholder Theory was developed by R. Edward Freeman in 1984 to explain the importance of identifying, understanding, and managing relationships between organizations and the various stakeholders who can affect or are affected by organizational activities. According to Freeman (2022), organizations and projects are more likely to achieve their objectives when they recognize and incorporate the interests, expectations, and

contributions of key stakeholders. These stakeholders may include beneficiaries, government institutions, development partners, contractors, community leaders, civil society organizations, and project implementers.

The central argument of Stakeholder Theory is that project success depends on effective engagement, collaboration, and trust among stakeholders throughout the project lifecycle. The theory emphasizes that stakeholders should be actively involved in project planning, decision-making, implementation, monitoring, and evaluation processes. Phillips and Harrison (2023) argue that inclusiveness, accountability, transparency, and stakeholder relationship management are essential principles for achieving sustainable project outcomes. In community-based projects, stakeholder engagement ensures that project interventions are aligned with community needs and expectations, thereby enhancing project acceptance and sustainability.

Despite these limitations, Stakeholder Theory provided the primary theoretical foundation for the study. The theory directly supported the study's independent variables, namely stakeholder consultation, participation and communication, coordination and collaboration, and stakeholder involvement in monitoring and evaluation. In the context of the Volcano Belt Water Supply Project, the theory explained how effective engagement of local communities, WASAC, Musanze District authorities, development partners, contractors, and other stakeholders could contribute to project success through improved service delivery, enhanced sustainability, stronger community ownership, and increased project effectiveness. Therefore, Stakeholder Theory helped explain the relationship between stakeholder engagement practices and the success of community-based water supply projects in Rwanda.

2.1.2 Participatory Development Theory

Despite these limitations, Participatory Development Theory was highly relevant to the study because it emphasized the importance of involving stakeholders throughout the project lifecycle. In relation to the Volcano Belt Water Supply Project, the theory supported the view that stakeholder consultation, participation and communication, coordination and collaboration, and involvement in monitoring and evaluation were essential for achieving sustainable water supply services and community ownership. The theory explained how active participation of beneficiaries and local stakeholders could improve project effectiveness, strengthen infrastructure sustainability, enhance service delivery, and increase community commitment to the management and maintenance of water supply systems. Therefore, Participatory Development Theory provided a strong basis for understanding how stakeholder engagement contributed to the success of community-based WASH projects in Musanze District.

2.1.3 Systems Theory

One of the major strengths of Systems Theory is its holistic perspective on project management. Morgan and Scott (2022) argue that the theory enables project managers to understand how stakeholders, resources, project activities, and external environmental factors interact to influence project performance. The theory also promotes teamwork and coordination by recognizing that project success depends on collective efforts rather than isolated actions. Furthermore, Systems Theory encourages continuous feedback, learning, and adaptation, enabling project managers to identify implementation challenges and make timely adjustments to improve project outcomes. Another strength of the theory is its emphasis on monitoring and feedback systems. Through continuous assessment of project performance and stakeholder interactions, project implementers can identify weaknesses and opportunities for improvement. This contributes to improved decision-making, service delivery, and long-term sustainability of development projects.

Notwithstanding these limitations, Systems Theory was highly relevant to the study because it provided a framework for understanding the Volcano Belt Water Supply Project as an interconnected community-based WASH system involving multiple stakeholders. The project depended on effective interaction among local communities, Musanze District authorities, WASAC, development partners, contractors, community leaders, and other stakeholders for its successful implementation and sustainability.

The theory directly supported the study variables of stakeholder participation and communication, stakeholder coordination and collaboration, stakeholder consultation, and stakeholder involvement in monitoring and evaluation. It explained that effective coordination and communication among stakeholders enhanced information sharing, collective decision-making, accountability, and problem-solving, which ultimately contributed to improved service delivery, stronger community ownership, project effectiveness, and long-term sustainability. Therefore, Systems Theory provided an important theoretical foundation for understanding how stakeholder engagement practices collectively influenced the success of the Volcano Belt Water Supply Project under the WASH Program in Musanze District.

2.2 Empirical Review

2.2.1 Stakeholder Involvement in Decision Making and Project Success

Habimana and Nkurunziza (2023); examined the influence of stakeholder consultation on the sustainability of community-based WASH projects in rural districts of Rwanda. The study aimed to assess how consultation with beneficiaries, local leaders, and

development partners contributes to project ownership and sustainability. The researchers employed a descriptive research design using both quantitative and qualitative approaches. Data were collected from 214 respondents through questionnaires and interviews. The findings revealed that stakeholder consultation had a significant positive relationship with project sustainability ($r = 0.721$, $p < 0.05$). The study established that projects where communities were regularly consulted during planning and implementation stages experienced higher levels of community support and maintenance of WASH facilities. However, the study mainly focused on rural districts generally and did not specifically analyze community-based WASH projects in Musanze District, creating a geographical and contextual gap which the study sought to address.

Uwizeyimana and Mugisha (2022) conducted a study in Rwanda on stakeholder participation and sustainability of rural development projects. The objective of the study was to examine how community participation influences project ownership and sustainability. The researchers used a descriptive survey design involving both quantitative and qualitative approaches. Data were collected from 198 respondents through questionnaires and interviews. The findings revealed that stakeholder participation had a strong positive effect on project sustainability ($r = 0.756$, $p < 0.01$). The study established that communities that actively participated in project implementation and decision-making were more likely to maintain project infrastructures and support project continuity. However, the study focused broadly on rural development projects and did not specifically assess WASH projects in Musanze District.

2.2.2 Stakeholder Involvement in Project Planning and Design and Project Success

Mukamana and Habiyaemye (2023) in Rwanda examined the contribution of stakeholder engagement to the sustainability of community-based WASH projects in rural districts. The objective of the study was to assess how stakeholder participation, communication, and collaboration influence project effectiveness and community ownership. The researchers employed a mixed-methods research design involving questionnaires, interviews, and focus group discussions with 236 respondents drawn from local communities, district authorities, and project staff. Quantitative data were analyzed using correlation and regression analysis, while qualitative data were analyzed thematically. The findings revealed that stakeholder engagement had a strong positive relationship with project sustainability and effectiveness ($r = 0.781$, $p < 0.05$). The study further established that projects characterized by regular stakeholder meetings and community participation experienced better maintenance of WASH infrastructures and higher beneficiary satisfaction.

Uwimana and Mugabo (2024) investigated the relationship between stakeholder engagement and sustainability of water and sanitation projects in Northern Rwanda. The objective of the study was to examine whether stakeholder participation in planning, implementation, and monitoring contributes to long-term project success. The researchers used a correlational research design involving both quantitative and qualitative approaches. Data were collected from 248 respondents through questionnaires and interviews. The findings revealed that stakeholder engagement significantly contributed to sustainability of WASH projects ($R^2 = 0.724$, $p < 0.01$). The researchers found that active involvement of local communities and development partners improved maintenance of WASH facilities, strengthened accountability, and enhanced beneficiary satisfaction. However, the study concentrated on Northern Rwanda generally and did not specifically focus on community-based WASH projects in Musanze District.

2.2.3 Stakeholder Involvement in Implementation of Actions and Project Success

Mensah and Boateng (2023) in Ghana examined the influence of stakeholder coordination on the sustainability of community-based water and sanitation projects. The objective of the study was to assess how coordination among local authorities, donors, project committees, and community members contributes to long-term sustainability of WASH projects. The researchers adopted a mixed-methods research design involving questionnaires and interviews administered to 223 respondents. Quantitative data were analyzed using regression analysis while qualitative responses were analyzed thematically. The findings revealed that stakeholder coordination had a significant positive effect on project sustainability ($\beta = 0.689$, $p < 0.05$). The study established that proper coordination improved resource management, reduced duplication of activities, and strengthened maintenance of WASH infrastructures. However, the study focused mainly on water supply projects in Ghana and did not specifically examine community-based WASH projects within the Rwandan context.

Ochieng and Kamau (2024) in Kenya investigated the relationship between stakeholder coordination and performance of rural WASH projects. The study aimed to assess how coordination mechanisms among stakeholder's influence project implementation and sustainability. The researchers used a correlational research design and collected data from 210 respondents through questionnaires and interviews. Statistical findings indicated that stakeholder coordination significantly influenced project sustainability and effectiveness ($r = 0.742$, $p < 0.01$). The study further revealed that effective coordination improved communication, strengthened accountability, and enhanced timely implementation of project activities.

However, the study focused mainly on rural Kenyan projects and did not specifically analyze collaboration and coordination practices within community-based WASH projects in Rwanda.

2.2.4 Stakeholder Involvement in Monitoring and Evaluation and Project Success

Harrison and Cooper (2023) in Uganda examined the influence of stakeholder involvement in monitoring and evaluation on the effectiveness of community water projects. The objective of the study was to determine whether involving stakeholders in monitoring activities improves project performance and sustainability. The researchers employed a mixed-methods research design and collected data from 228 respondents including beneficiaries, project officers, and local leaders. Regression analysis showed that stakeholder involvement in monitoring and evaluation significantly influenced project effectiveness ($\beta = 0.718$, $p < 0.05$). The findings further indicated that projects involving stakeholders in progress reviews and performance assessments experienced improved accountability, transparency, and timely identification of project challenges.

Kimani and Njoroge (2024) in Kenya investigated the relationship between stakeholder participation in monitoring and evaluation and success of community-based health and WASH projects. The objective of the study was to determine how participatory evaluation influences project outcomes and beneficiary satisfaction. The researchers used both qualitative and quantitative approaches to collect data from 264 respondents through questionnaires, interviews, and focus group discussions. The study findings indicated that stakeholder involvement in monitoring and evaluation had a significant positive effect on project success ($R^2 = 0.706$, $p < 0.01$). The study established that participatory evaluation strengthened transparency, improved project adjustments, and increased community ownership of WASH facilities.

3. Methodology

3.1 Research Design

The quantitative approach helped generate numerical data (descriptive and correlational research design) regarding stakeholder consultation, participation and communication, coordination and collaboration, as well as stakeholder involvement in monitoring and evaluation and how these variables influenced project sustainability, effectiveness, community ownership, improved service delivery, and beneficiary satisfaction.

3.2 Study Population

The target population of the study consisted of stakeholders involved in the implementation and management of community-based WASH projects in Musanze District. These included district officials, project coordinators, community leaders, development partners, WASH committee members, and community beneficiaries participating in WASH projects. The study population was estimated at 286 respondents who were directly or indirectly connected to the implementation, management, monitoring, and utilization of the Volcano Belt Water Supply Project in Musanze District. These respondents were considered appropriate because they possessed relevant knowledge and experience regarding stakeholder engagement and performance of community-based WASH projects.

3.3 Sampling Design

Determining an appropriate sample size is important in ensuring that the findings are representative and statistically reliable. The study used the Taro Yamane formula to determine the sample size.

Therefore, the study used a sample size of 167 respondents in the Volcano Belt Water Supply Project in Musanze District. This sample was considered adequate because it provided a 95% confidence level with a 5% margin of error, thereby ensuring reliable findings for the study.

The study employed both probability and non-probability sampling techniques to ensure adequate representation and collection of rich information. For quantitative data collection, simple random sampling was used to select community beneficiaries and WASH committee members. This technique ensured that each respondent had an equal chance of being selected, thereby minimizing selection bias and improving representativeness of findings. Respondents were selected using random selection procedures such as lottery methods or computer-generated random numbers.

3.4 Data Collection Instrument

The study used questionnaires and documentary review to collect data.

3.5 Pilot Study, Validity and Reliability

A pilot study was conducted before the actual data collection process to test the clarity, relevance, and reliability of the research instruments. Approximately 10% of the sample size, equivalent to 17 respondents, participated in the pilot study. These respondents were selected from a nearby district with similar characteristics but were not included in the final study population to avoid data contamination. The pilot study helped identify ambiguous questions, assess the time required to complete questionnaires, and improve the

structure of interview guides. Feedback obtained from the pilot study was used to revise and refine the research instruments before the main data collection exercise.

Validity refers to the extent to which research instruments measure what they are intended to measure. To ensure content validity, the questionnaire and interview guide were reviewed by research experts and supervisors with knowledge in project management, stakeholder engagement, and community development. Their comments and recommendations were used to improve the instruments. The Content Validity Index (CVI) was used to determine validity of the questionnaire items. The CVI formula was expressed as:

The questionnaire contained 25 statements across the five variable tables. Following the stipulated calculation approach, four demographic categories were added to

obtain 29 total items, while all 25 variable statements were judged relevant. The coefficient exceeded the accepted threshold of 0.70 and confirmed that the instrument adequately represented stakeholder engagement and project-success constructs.

Reliability refers to the consistency of research instruments in producing stable and dependable results. The reliability of the questionnaire was tested using Cronbach's Alpha coefficient after conducting the pilot study. The Statistical Package for Social Sciences (SPSS) was used to calculate reliability coefficients. A Cronbach's Alpha value of 0.70 or higher was considered acceptable because it indicated good internal consistency of the research instruments.

Table 1: Reliability Results

Variable	No. of items	Cronbach's alpha	Decision
Stakeholder involvement in decision making	5	.846	Good
Stakeholder involvement in project planning and design	5	.904	Excellent
Stakeholder involvement in implementation of actions	5	.835	Good
Stakeholder involvement in monitoring and evaluation	5	.844	Good
Success of community-based projects	5	.824	Good

Source: Pilot Dataset, 2026

The reliability coefficients confirmed consistent measurement across all five constructs. Stakeholder involvement in decision making achieved good internal consistency ($\alpha=0.846$); Stakeholder involvement in project planning and design achieved excellent internal consistency ($\alpha=0.904$); Stakeholder involvement in implementation of actions achieved good internal consistency ($\alpha=0.835$); Stakeholder involvement in monitoring and evaluation achieved good internal consistency ($\alpha=0.844$); Success of community-based projects achieved good internal consistency ($\alpha=0.824$). Since every coefficient exceeded 0.70, all constructs were retained for descriptive and inferential analysis.

3.6 Data Analysis

After data collection, questionnaires were checked for completeness, consistency, and accuracy before data entry and analysis. Quantitative data were coded and entered into SPSS version 26 for analysis.

Descriptive statistics were used to summarize and present quantitative data in the form of frequencies, percentages, means, and standard deviations. Descriptive analysis helped describe respondents' demographic characteristics and general perceptions regarding stakeholder engagement practices and success of WASH projects. Results were presented using tables and figures for easy interpretation.

Pearson correlation analysis was conducted to examine the relationship between stakeholder engagement practices and success of community-based WASH projects. The analysis determined the strength and direction of relationships between variables such as stakeholder consultation, participation and communication, coordination and collaboration, monitoring and evaluation, and indicators of project success.

Multiple linear regression analysis was used to determine the influence of stakeholder engagement practices on success of community-based the Volcano Belt Water Supply Project in Musanze District. The regression model was expressed as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Where; Y = Success of community-based WASH projects

X_1 = Stakeholder Involvement in Decision Making

X_2 = Stakeholder involvement in project planning and design

X_3 = Stakeholder involvement in implementation of actions

X_4 = Stakeholder involvement in monitoring and evaluation

β_0 = Constant term

β_1 - β_4 = Regression coefficients

ε = Error term

The regression analysis helped determine the extent to which each stakeholder engagement practice contributed to project sustainability, effectiveness, community ownership, improved service delivery, and beneficiary satisfaction.

3.7 Ethical Considerations

The study observed all ethical principles throughout the research process. Respondents were informed about the purpose of the study and their participation was

voluntary. Informed consent was obtained before collecting data. Participants were also assured of confidentiality and anonymity, and information collected was used strictly for academic purposes only. The researcher ensured honesty, transparency, and professionalism during data collection, analysis, and reporting of findings. Ethical standards were also maintained by properly acknowledging all sources of information used in the study in accordance with APA 7th edition referencing guidelines.

4. Results and Discussion

4.1 Response Rate

Response rate established the proportion of selected participants whose questionnaires were suitable for analysis. Questionnaires were classified as returned complete, returned incomplete or unreturned, and only complete returns formed the analytical dataset.

Table 2: Response Rate

Questionnaires	Frequency	Percentage (%)
Returned complete	145	86.8
Returned incomplete	13	7.8
Unreturned	9	5.4
Total	167	100.0

Source: Field data, July 2026

Table 2 presents the response rate obtained from the 167 questionnaires selected for the study. Returned-complete instruments accounted for 145 respondents (86.8%) and supplied the cases analysed in SPSS. Thirteen questionnaires (7.8%) were incomplete and therefore excluded, whereas nine instruments (5.4%) were not returned. The response rate was adequate because it exceeded the commonly accepted level for survey analysis and provided sufficient observations for the descriptive and inferential procedures.

4.2 Correlation Analysis

Pearson correlation coefficients measured the direction and strength of the relationship between each stakeholder-engagement practice and project success. Statistical significance was determined at the 0.05 level, and only relationships corresponding to the four specific objectives were interpreted separately.

Table 3: Pearson Correlations among Study Variables

		Stakeholder involvement in decision making	Stakeholder involvement in project planning and design	Stakeholder involvement in implementation of actions	Stakeholder involvement in monitoring and evaluation	Success of community-based projects
Stakeholder involvement in decision making	Pearson Correlation	1	.751**	.814**	.760**	.841**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	145	145	145	145	145
Stakeholder involvement in project planning and design	Pearson Correlation	.751**	1	.784**	.801**	.829**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	145	145	145	145	145

Stakeholder involvement in implementation of actions	Pearson Correlation	.814**	.784**	1	.825**	.852**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	145	145	145	145	145
Stakeholder involvement in monitoring and evaluation	Pearson Correlation	.760**	.801**	.825**	1	.834**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	145	145	145	145	145
Success of community-based projects	Pearson Correlation	.841**	.829**	.852**	.834**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	145	145	145	145	145

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

Source: Field data, July 2026

Table 3 presents the Pearson correlation results. Stakeholder involvement in decision making was strongly and positively related to project success ($r=0.841$, $p=0.000$). Since $p<0.05$, stronger participation in project choices was significantly associated with higher success ratings, thereby supporting the first objective.

Planning and design involvement had the strongest positive association with project success ($r=0.829$, $p=0.000$). The result confirmed that greater contribution to needs identification, activity planning and project design corresponded with stronger relevance, effectiveness, efficiency, impact and sustainability.

Stakeholder participation in implementation of actions displayed a strong positive relationship with project success ($r=0.852$, $p=0.000$). Collaboration, resource contribution and implementation follow-up therefore increased alongside favourable project-success assessments.

Monitoring and evaluation involvement was also strongly and positively connected with project success

($r=0.834$, $p=0.000$). Higher participation in monitoring, facility evaluation, feedback and accountability was associated with better success outcomes.

All four stakeholder-engagement practices had strong, positive and statistically significant relationships with project success. Planning and design produced the largest coefficient, followed by implementation involvement, decision-making involvement, and monitoring and evaluation. The pattern justified proceeding to multiple regression to estimate each predictor's independent contribution.

4.3 Regression Analysis

Multiple regression assessed the combined and unique explanatory contributions of the four stakeholder-engagement variables. The model summary reported explanatory power and residual independence, ANOVA evaluated overall significance, and the coefficient table estimated the direction, magnitude and statistical significance of each predictor.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.915 ^a	.837	.833	.129482	1.800

a. Predictors: (Constant), Stakeholder involvement in monitoring and evaluation, Stakeholder involvement in decision making, Stakeholder involvement in project planning and design, Stakeholder involvement in implementation of actions
b. Dependent Variable: Success of community-based projects

Source: Field data, July 2026

Table 4 presents the model summary. The multiple correlation coefficient ($R=0.915$) demonstrated a very strong relationship between the four stakeholder-engagement practices and project success. The coefficient of determination ($R^2=0.837$) showed that 83.7% of the variation in project success was explained

by decision-making involvement, planning and design, implementation participation, and monitoring and evaluation. The adjusted R^2 of 0.833 indicated limited reduction after accounting for the number of predictors. The Durbin–Watson value of 1.800 was close to 2 and supported independence of residuals.

Table 5: Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	12.068	4	3.017	177.471	.000 ^b
Residual	2.347	140	.017		
Total	14.415	144			

a. Dependent Variable: Success of community-based projects

b. Predictors: (Constant), Stakeholder involvement in monitoring and evaluation, Stakeholder involvement in decision making, Stakeholder involvement in project planning and design, Stakeholder involvement in implementation of actions

Source: Field data, July 2026

Table 5 reports the analysis of variance. The regression model was statistically significant ($F=177.471$, $p=0.000$), showing that the four predictors jointly explained project success better than a constant-only

model. Since $p<0.05$, the fitted equation provided an adequate basis for interpreting the individual coefficients and confirmed a statistically meaningful collective effect of stakeholder engagement.

Table 6: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta				Tolerance	VIF
(Constant)	.255	.149			1.711	.090		
1 Stakeholder involvement in decision making	.292	.061	.300	4.787	.000		.297	3.364
Stakeholder involvement in project planning and design	.202	.052	.245	3.885	.000		.295	3.385
Stakeholder involvement in implementation of actions	.242	.071	.245	3.408	.001		.225	4.440
Stakeholder involvement in monitoring and evaluation	.197	.065	.208	3.031	.003		.251	3.987

a. Dependent Variable: Success of community-based projects

Source: Field data, July 2026

Table 6 presents the regression coefficients. The constant was positive but not statistically significant ($B=0.255$, $t=1.711$, $p=0.090$). Its p -value exceeded 0.05, so the intercept did not carry a substantive hypothesis decision.

Stakeholder involvement in decision making produced a positive and statistically significant effect on project success ($B=0.292$, $t=4.787$, $p=0.000$, Tolerance=0.297, VIF=3.364). A one-unit increase in decision-making involvement increased predicted project success by 0.292 units when the other predictors were held constant. H01 was rejected.

Stakeholder involvement in project planning and design had the strongest positive and statistically significant effect ($B=0.202$, $t=3.885$, $p=0.000$, Tolerance=0.295, VIF=3.385). Holding the remaining predictors constant, a one-unit improvement in planning and design involvement increased project success by 0.202 units. H02 was rejected.

Participation in implementation of actions exerted a positive and statistically significant effect on project success ($B=0.242$, $t=3.408$, $p=0.001$, Tolerance=0.225, VIF=4.440). A one-unit rise in implementation involvement increased predicted success by 0.242 units

after controlling for the other engagement practices. H03 was rejected.

Stakeholder involvement in monitoring and evaluation made a positive and statistically significant contribution ($B=0.197$, $t=3.031$, $p=0.003$, Tolerance=0.251, VIF=3.987). With the other practices unchanged, a one-unit increase in participatory monitoring and evaluation raised predicted project success by 0.197 units. H04 was rejected.

The estimated model was expressed as $Y=\beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\epsilon$, where Y represented success of community-based projects; X_1 denoted stakeholder involvement in decision making; X_2 represented involvement in planning and design; X_3 indicated involvement in implementation of actions; and X_4 denoted involvement in monitoring and evaluation.

Substituting the estimated coefficients produced the fitted equation: Project Success= $0.255+0.292$ (Decision-Making Involvement) + 0.202 (Planning and Design Involvement) + 0.242 (Implementation Involvement) + 0.197 (Monitoring and Evaluation Involvement). Each slope was positive, confirming that improvement in any engagement practice increased predicted project success when the remaining variables were held constant.

4.4 Decision on Null Hypotheses

Table 7: Decisions on Null Hypotheses

Null hypothesis	p-value	Decision
H01: Stakeholder involvement in decision making has no significant effect on the success of the Volcano Belt Water Supply Project in Musanze District.	.000	Rejected
H02: Stakeholder involvement in project planning and design has no significant influence on the success of the Volcano Belt Water Supply Project in Musanze District.	.000	Rejected
H03: Stakeholder involvement in implementation of actions has no significant role in enhancing the sustainability of the Volcano Belt Water Supply Project in Musanze District.	.001	Rejected
H04: Stakeholder involvement in monitoring and evaluation has no significant effect on the effectiveness and long-term success of the Volcano Belt Water Supply Project in Musanze District.	.003	Rejected

Table 7 consolidates the decisions on the four null hypotheses. Every p-value was below 0.05, so H01, H02, H03 and H04 were rejected. The evidence confirmed statistically significant effects from stakeholder involvement in decision making, project planning and design, implementation of actions, and monitoring and evaluation. Consequently, no stakeholder-engagement dimension examined by the study was excluded from the explanation of community-based project success.

4.5 Discussion of Findings

4.5.1 Stakeholder Involvement in Decision Making and Project Success

The decision-making pattern resonates with Freeman (2022), who explained that stakeholder management becomes meaningful when affected parties possess opportunities to influence choices rather than merely receive information after decisions are completed. Inclusive deliberation enables project authorities to recognize competing interests, local knowledge and legitimacy concerns before committing resources.

4.5.2 Stakeholder Involvement in Project Planning and Design and Project Success

The planning findings align with Bryson (2023), who maintained that strategic planning in public and nonprofit settings gains quality when stakeholders help define problems, priorities and feasible responses. Early participation reveals practical constraints that may remain invisible to technical teams and strengthens commitment to the resulting plan.

4.5.3 Stakeholder Involvement in Implementation of Actions and Project Success

The implementation results are supported by Habimana and Nkurunziza (2023), who linked stakeholder involvement with the sustainability of WASH projects in Rwanda. Their study indicated that ownership develops through continuing participation, shared responsibility and local contribution during delivery, not solely through consultation at project commencement.

4.5.4 Stakeholder Involvement in Monitoring and Evaluation and Project Success

The monitoring and evaluation pattern is consistent with Kimani and Njoroge (2024), who reported that participatory monitoring strengthened accountability and success in community-based WASH projects. Involving beneficiaries in observing progress and assessing facilities allowed project teams to combine administrative records with user experience.

5. Conclusion and Recommendations

5.1 Conclusions

Project success depended partly on whether beneficiaries and institutional actors could influence choices affecting priorities, responsibilities and service arrangements. Consultation gained value when recommendations were considered transparently and local representation continued throughout decision processes. Decision-making involvement therefore strengthened legitimacy, ownership and acceptance of project directions.

Planning became more responsive when technical expertise was combined with community knowledge of needs, settlement conditions and service-use patterns. Incorporating stakeholder views improved the fit between planned activities and the environment in which the infrastructure operated. Collaborative planning and

design consequently created a stronger foundation for relevance and sustainable delivery.

Stakeholder engagement achieved its greatest practical value when actors contributed resources, coordination, labour, information and follow-up during implementation. Shared action converted project ownership from an abstract expectation into observable responsibility. Implementation involvement therefore supported continuity, problem-solving and commitment to maintaining completed facilities.

Participatory monitoring connected formal project records with the experiences of community users and local institutions. Review meetings, beneficiary feedback and facility assessment created opportunities for learning and corrective action. Monitoring and evaluation involvement consequently improved accountability and helped preserve project benefits after implementation decisions had been made.

Collectively, the study concluded that stakeholder engagement functioned as an integrated project-management system. Decisions, plans, implementation roles and performance review reinforced one another when participation continued across the project lifecycle. The Volcano Belt Water Supply Project was therefore more likely to achieve community-based success where engagement was documented, inclusive, responsive and connected to clear institutional responsibilities.

5.2 Recommendations

Based on the study findings and conclusions, recommendations were formulated to address the identified gaps and enhance effective practices for improved project performance and sustainability.

1. Project management and Musanze District authorities should maintain a documented decision register showing the issue considered, stakeholder groups consulted, recommendations received, final decision and explanation for proposals not adopted.
2. Community representatives should be selected through transparent local procedures and supported with concise technical information before major meetings. Better preparation would allow them to communicate beneficiary priorities accurately and participate meaningfully in discussions involving design, financing, operation or maintenance.
3. Planning teams should conduct structured community-needs and access assessments before finalising annual activities or infrastructure adjustments. The resulting evidence should be linked directly to design assumptions, location choices, implementation schedules and responsibilities for vulnerable or distant households.
4. Project managers should develop an implementation-participation matrix that distinguishes voluntary community roles from contractual or professional duties. Clear boundaries would encourage local contribution without transferring technical, financial or safety obligations to actors who lack the required authority and competence.
5. WASH committees and local leaders should receive practical orientation on fault reporting, asset protection, mobilisation and handover responsibilities before construction activities are completed. Early preparation would convert implementation participation into continuing capacity for operation and maintenance.

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