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Influence of Comprehensive Project Planning on Project Success in Rwanda. A Case of Nzove Water Supply Project (2021-2024)

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Abstract: *The general objective of this study was to investigate the influence of comprehensive project planning on success of Nzove Water Supply Project in Rwanda. The research design was combined descriptive and correlational research design to structure the data collection, analysis processes, and data analysis was conducted using SPSS 25. The model shows a strong positive relationship between these factors and project success, with an R value of 0.858, indicating a significant linear association. The R-square value of 0.736 implies that 73.6% of the variance in project success can be explained by these factors, while the Adjusted R-Square of 0.730 provides a slight adjustment for the number of predictors. The unstandardized coefficient for Comprehensive Scope Planning is 0.579, indicating that a one-unit increase in Comprehensive Scope Planning results in a 0.579-unit increase in project success (β = 0.579, t = 8.773, P = 0.000<0.05). The unstandardized coefficient for Comprehensive Budget Planning is 0.174, indicating that a one-unit increase in Comprehensive Budget Planning results in a 0.174-unit increase in project success (β = 0.174, t = 2.384, P = 0.019<0.05). The coefficient for Comprehensive Management Planning is 0.178, indicating that a one-unit increase in Comprehensive Risk Management Planning results in a 0.178-unit increase in the success of the Nzove Water Supply Project, but it is not statistically significant (β = 0.178, t = 2.580, P = 0.011< 0.05). The study recommended that project managers ensure clear scope documentation, frequent budget assessments, and proactive risk management to enhance the Nzove Water Supply Project's success.*

Keywords: *Comprehensive Project Planning, Scope Planning, Budget Planning, Risk Management Planning and Project Success*

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1. Introduction

In Rwanda, effective project planning is crucial for enhancing development and ensuring the efficient use of resources. Given the challenges of the local environment and land limitations, planning efforts prioritize optimal resource management and utilization to support sustainable growth and development across various sectors. According to Mutesi (2021), National Agricultural Intensification Program focuses on efficient resource management and optimal land use due to the country's dependence on rain-fed agriculture and limited arable land. Comprehensive project planning in Rwanda significantly influences the performance of housing construction projects. Key components such as project scope, resource, and risk planning are essential for achieving success in the sector. Their effective implementation leads to improved project outcomes, maximizing resources and addressing challenges in Kigali City (Utuje & Kwena, 2024). Furthermore, Comprehensive project planning is important for enhancing the performance of leasing projects implemented by BDF in Kigali. Key aspects such as project scope, resource, time, and communication planning significantly influence project outcomes.

Effective planning enables resource mobilization, stakeholder engagement, and timely completion, ultimately promoting project success in Rwanda (Miringiro & Dushimimana, 2023).

Scheduling aligns activities with critical treatment cycles to optimize water quality and availability. Engaging stakeholders involves collaboration with local communities, health officials, and water management authorities to ensure projects address local water needs effectively. Risk management tackles challenges related to water scarcity and contamination, implementing adaptation strategies to enhance resilience. Monitoring and evaluation systems are essential for tracking water quality and usage, facilitating timely adjustments to improve project outcomes. This comprehensive planning approach supports sustainable water management, enhances public health, and strengthens community resilience to environmental changes (Mperejekumana *et al.*, 2024).

One of the growing problems in developing countries is the unsustainability of projects. Many non-governmental organization projects executed by local governments and other agencies through a top-down model lack local community involvement at any stage of the program life cycle. Consequently, 40% of project interventions in Rwanda are not sustained for one to two years after funding withdrawal. Additionally, a low percentage of goods and services are maintained and delivered five years after project termination, leading to stagnation of local action and an inability to generate successor services and initiatives (Mutanguha & Kamuhanda, 2021).

Inadequate planning and contract management are the main issues that have arisen during the implementation of public projects in Rwanda. All these issues have had a significant negative impact on national undertakings (Hatumimana & Dushimimana, 2024).

According to Majoro *et al.* (2020), Water treatment projects sourced from the Sebeya River in Rwanda face challenges due to high sediment loads and turbidity resulting from mining and agricultural activities. Contamination from e. coli and organic pollutants further compromises water quality. In Rwanda, approximately 13% of the population lacks access to improved water sources, and 14% lacks sanitation facilities, with inequalities evident as 15% of rural residents lack potable water compared to just 4% in urban areas. Furthermore, 9.8% of people use pit latrines without slabs, and 4.4% obtain water from surface sources. Comprehensive project planning can address these challenges by ensuring adequate funding, enhancing coordination among stakeholders, and promoting community involvement, thereby improving infrastructure and access to safe water and sanitation for all (Twagirayezu *et al.*, 2023).

Access to safe and reliable water from the Nzove treatment plant is critical for the health and quality of life of Kigali's inhabitants. However, the plant faces significant challenges, including high turbidity levels, with evidence of broken pipelines contributing to this issue. Customer feedback is insufficient, as only 28.4% of users report their concerns, while 91% express difficulty in communicating with the water provider. Currently, the Nzove plant produces only 64,000 m^3/day, which falls short of Kigali's demand of approximately 90,000 m^3/day, resulting in a water deficit of 26,000 m^3. Additionally, poor water quality and insufficient infrastructure exacerbate the situation (Irumva & Twagirayezu, 2020).

Several studies, Hatumimana and Dushimimana (2024), Mutanguha & Kamuhanda (2021), Majoro *et al.* (2020) and Twagirayezu *et al.* (2023) have examined projects' success in Rwanda, highlighting issues such as unsustainability, and water quality challenges, yet they often overlook the critical role of comprehensive project planning. There are documented inefficiencies and insufficient community involvement in existing projects, gaps remain in addressing the planning process itself. This study on influence of comprehensive project planning on project success in Rwanda: A Case of Nzove Water Supply Project, aims to fill this gap by analyzing how structured planning enhanced success of Nzove Water Supply Project.

The general objective of this study was to investigate the influence of comprehensive project planning on success of Nzove Water Supply Project.

Specifically, the study had the following objectives:

1. To determine the influence of comprehensive scope planning on success of Nzove Water Supply Project in Rwanda.
2. To assess the influence of comprehensive budget planning on success of Nzove Water Supply Project in Rwanda.
3. To evaluate the influence of comprehensive risk management planning on success of Nzove Water Supply Project in Rwanda.

The following research null hypotheses were developed:

H_{01}: There is no significant effect of comprehensive scope planning on success of Nzove Water Supply Project in Rwanda.

H_{02}: There is no significant effect of comprehensive budget planning on success of Nzove Water Supply Project in Rwanda.

H_{03}: There is no significant effect of comprehensive risk management planning on success of Nzove Water Supply Project in Rwanda.

2. Literature Review

2.1 Resource-Based view theory

The Resource-Based View (RBV) theory, first developed by Birger Wernerfelt in 1984 and expanded by scholars like Jay Barney, offers a strategic framework emphasizing the importance of an organization's unique resources as a primary source of competitive advantage. According to RBV, resources are categorized as Valuable, Rare, Inimitable, and Non-Substitutable (VRIN). When an organization possesses these VRIN resources, it can achieve sustained competitive advantage that is difficult for competitors to replicate. The theory posits that organizations should invest in acquiring and developing resources and capabilities that align with their strategic goals. This investment is particularly crucial because it allows organizations to navigate complex environments with unique internal strengths, thereby optimizing their chances of achieving long-term objectives (Šmaguc, 2022).

RBV also emphasizes the role of internal resources, such as skilled employees, technological capabilities, and financial resources, in driving organizational success. The theory shows that external opportunities are only valuable to the extent that an organization's internal resources can be deployed to take advantage of them effectively. For example, high-quality human capital enables organizations to engage in innovative practices, while financial capital provides flexibility in strategic decision-making. By focusing on cultivating and deploying these resources, organizations can create a strong foundation for achieving their objectives, whether in competitive markets or project-based environments. The RBV framework, therefore, provides a powerful rationale for internal resource investment and development, framing these as the key components of sustainable success (Kero & Bogale, 2023).

Resource-Based View Theory guided Nzove Water Supply Project in leveraging unique internal resources, such as skilled personnel and specialized technology, to create a sustainable competitive advantage. By focusing on valuable, rare, inimitable, and non-substitutable resources, the project enhanced operational efficiency and achieved long-term success in water supply delivery.

2.2 Empirical Review

Mwangi and Yusuf (2022) aimed to establish the role of scope management in the successful implementation of health infrastructural programs in Nairobi County. It evaluated four key factors affecting project scope management: scope planning, scope budgeting, scope scheduling, and scope control. The research involved 120 personnel engaged in the construction of 40 health facilities. A questionnaire was employed to collect data, with a content validity check conducted by a supervisory panel. Reliability testing using Cronbach's Alpha yielded a threshold value of 0.7 for reliable measures. Data analysis utilized the Statistical Package for the Social Sciences (SPSS), applying descriptive statistics to derive mean scores and standard deviations, along with multiple regression analysis. Results indicated that scope planning, budgeting, scheduling, and control significantly influenced the implementation of infrastructural health projects, demonstrating that increases in these areas led to enhanced successful implementation rates of health infrastructural programs.

Nsengiyumva and Njenga (2021) investigated the impact of budget management on project performance within Rwanda's Equity Agency Banking initiative, focusing on fund allocation, budget execution, and variance determination. Guided by agency, utility, and uncertainty theories, the study explored how top management support and technical aspects shaped the project's budget management effectiveness. A descriptive survey method analyzed budget-related factors, revealing insights into agency banking performance at Equity Bank Rwanda. The survey targeted 250 professionals involved in agency banking, with a final sample of 154 respondents chosen via Yamane's formula and stratified random sampling. Data were collected using structured questionnaires and analyzed in SPSS Version 23 through descriptive statistics, covering central tendency and dispersion metrics. Findings indicated that all budget management components were statistically significant. The study recommended that Equity Agency Banking proactively assign project risks to suitable partners from project initiation to ensure efficient budget and variance management for enhanced project performance.

Munawwarah *et al.* (2023) investigated the impact of budget planning and human resource quality on budget absorption levels within Regional Apparatus Organizations (OPD) in North Sumatra Province. By employing a hypothesis-testing approach and multiple linear regression, data was analyzed from 35 OPD, gathered through questionnaires. Findings showed a significant relationship between budget planning and budget absorption, with a regression coefficient (β) of 0.190, indicating that each unit increase in budget planning leads to a 0.190-unit rise in absorption rate on an interval scale. The results demonstrated that comprehensive budget planning and skilled human resources positively affect absorption levels, as inadequacies in planning or misalignment between budget and program execution often result in reduced efficiency. Budget planning and human resource quality were found to be instrumental in improving budget absorption rates, with an R-value indicating a strong positive link between these variables and budget performance. Enhancing budget planning processes and investing in financial management capacities can potentially raise absorption rates across government programs.

Yetgin and Yılmaz (2022) investigated the strategic planning and risk management of China's "One Belt, One Road Project," a large-scale initiative launched in 2013 to revive the Silk Road, connecting China with Asia, Africa, and Europe for expanded trade and economic collaboration. China, the project's core, leverages its geographic and economic influence, controlling key aspects of land, rail, and maritime trade and ensuring energy security through agreements with route nations. The project enhances China's regional dominance, while Turkey's strategic position aids in distributing multinational goods, boosting market competition. Given the project's vast financial scale, involvement of numerous countries, and multiple commercial interests, various risks have emerged. Using descriptive analysis, this research assesses the project's stages and creates a risk analysis aligned with a strategic planning model. With completion anticipated by 2049, addressing risks will be crucial for operational effectiveness, allowing the project to facilitate global economic integration and regional stability.

Karasira and Irechukwu (2021) examined the impact of project planning on the success of project implementation at the Sebeya Water Resource Board in Rubavu District, Rwanda. The study specifically analyzed the effects of scope planning, resource planning, and duty planning on project implementation. Using a descriptive research design, both qualitative and quantitative approaches were employed. A sample of 138 respondents was selected from a population of 1170 employees and 9 key informants. The analysis revealed significant positive correlations between scope planning and efficiency ($r = 0.890$, $p = 0.000$), productivity ($r = 0.935$, $p = 0.000$), and control ($r = 0.893$, $p = 0.000$). Resource planning also showed positive correlations with efficiency ($r = 0.891$, $p = 0.039$), productivity ($r = 0.896$, $p = 0.000$), and control ($r = 0.853$, $p = 0.000$). Duty planning demonstrated strong positive correlations with efficiency ($r = 0.953$, $p = 0.000$), productivity ($r = 0.890$, $p = 0.000$), and control ($r = 0.875$, $p = 0.000$). These findings highlight the critical role of project planning in enhancing project implementation success.

3. Methodology

The research methodology, research strategy, and discussion of the study's approach were all take place in this part. The study's population, sampling techniques, data collection and analysis methodologies, and the reasoning behind their use were all be laid out in great detail.

3.1. Research design

The study adopted both descriptive and correlational designs. Descriptive analysis provided an overview and significant aspects of the dataset, offering insights into trends and patterns. Correlational analysis examined the strength of relationships between comprehensive scope planning, comprehensive budget planning, comprehensive risk management planning and success of project aiding in understanding how they are interrelated.

3.2. Population of the study

For this study, the target population for Nzove Water Supply Project included 201 individuals across key participant categories, specifically 4 Nzove Water Supply Project managers, 4 project coordinators, 140 project site staffs, 41 WASAC Staff and 12 local leaders in Nyarugenge District as direct stakeholders of Nzove Water Supply Project.

3.3. Sampling Design

To compute the sample size for this research, Slovin's formula was used as it provides a straightforward method for determining the appropriate sample size. The researcher employed the following formula:

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

When applied to the provided sample, this formula yields a sample size of 134.

$$n = \frac{201}{1 + 201(0.05)^2} = \frac{201}{1 + 201(0.0025)} = \frac{201}{1 + 0.5025} = \frac{201}{1.5025} = 133.7 = 134$$

Stratified sampling was used in to ensure that specific subgroups within a population are adequately represented in the sample. This method involved dividing the population into groups. The rresearcher randomly selected samples from each group proportionate to size in the overall population.

3.4 Data Collection methods and instruments

For this study, participants completed a survey in which each question included multiple response options, allowing them to select the answers that best applied to them. The surveys were completed by participants at their own convenience and returned to the researcher within the specified timeframe using the same method of distribution.

3.5. Data analysis

To investigate the relationships between comprehensive project planning variables (scope planning, budget planning, and risk management planning) and the success of Nzove Water Supply Project, inferential statistics, including correlation analysis were used. This helped to assess the strength and nature of these

relationships. The adopted model for analysis was structured as follows:

$Y= \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\epsilon$

Where:

Y = Success of Project

X_1 =Comprehensive Scope planning

X_2 = Comprehensive Budget planning

X_3 = Comprehensive Risk management planning

β_0 = Constant (intercept)

β_1, β_2, β_3 = Coefficients indicating the strength of each variable's influence on project success

ϵ = Error term

3.6. Ethical considerations

The researcher emphasized gaining informed permission from participants prior to their participation in the study. This included telling participants about the study's aim, methods, and possible dangers so that they may make an educated choice about their participation. Permission was requested from appropriate management to enable participation from their members, backed up by formal paperwork such as an authorization letter. Confidentiality and privacy were rigorously enforced during the project. The researcher ensured that any personal information obtained from participants was kept confidential, and all data were securely stored. Adhering to these ethical standards protected participants' rights and dignity while also enhancing the validity and reliability of the research findings.

4. Results and Discussion

The results presented in this section are based on information collected from surveys administered in the field. After that, the researcher ran the numerical data via SPSS to look for trends and patterns.

4.1. Response Rate

The response rate is the percentage of completed surveys compared to the total number of eligible participants, calculated by dividing completed surveys by eligible participants. There were 134 questionnaires issued for this research; 130 were returned, with 4 being incomplete. In order to get the response rate, the researcher took the total number of questionnaires sent, divided it by the number of completed questionnaires, and then multiplied the result by 100 to get the percentage.

Table 1: Response Rate

Distributed questionnaire	Filled	Incomplete
134	130	4
100%	97.01%	2.99

Source: Field data, 2025

Table 1 presents the response rate. Out of the 134 questionnaires distributed, 130 were completed and returned, resulting in a response rate of approximately 97.01%. This high response rate indicates a strong level of engagement among participants, showing that the questionnaire was effectively designed and relevant to the respondents. The fact that only 4 questionnaires were returned incomplete shows that a significant majority provided comprehensive feedback, enhancing the quality of the collected data. The results demonstrate successful outreach to the target audience and the effectiveness of the survey instrument in capturing valuable information.

4.2 Inferential statistics

Inferential statistics aim to draw conclusions from a statistical sample. Various procedures, including regression analysis, confidence intervals, hypothesis testing, and correlation analysis, are utilized. Inferential statistics, including hypothesis testing, correlation, and regression analysis, were employed to examine the relationships between key variables and assess their influence on the success of the Nzove Water Supply Project. The analysis was guided by three alternative hypotheses: Comprehensive scope planning does not significantly impact the success of the Nzove Water Supply Project (H01). Comprehensive budget planning does not significantly impact the success of the Nzove Water Supply Project (H02). Comprehensive risk management planning does not significantly impact the success of the Nzove Water Supply Project (H03).

4.2.1 Correlation analysis

The correlation analysis involved examining the relationship between the independent and dependent variables of the study. The researcher conducted the Pearson correlation analysis, as detailed in Table 2 below.

Table 2: Correlations

		Comprehensive Scope planning	Comprehensive Budget planning	Comprehensive Risk management planning	Success of Project
Comprehensive Scope planning	Pearson Correlation	1	.717**	.628**	.828**
	Sig. (2-tailed)		.000	.000	.000
	N	130	130	130	130
Comprehensive Budget planning	Pearson Correlation	.717**	1	.753**	.738**
	Sig. (2-tailed)	.000		.000	.000
	N	130	130	130	130
Comprehensive Risk management planning	Pearson Correlation	.628**	.753**	1	.686**
	Sig. (2-tailed)	.000	.000		.000
	N	130	130	130	130
Success of Project	Pearson Correlation	.828**	.738**	.686**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	130	130	130	130

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

Source: Field data, 2025

Table 2 presents the Pearson correlation analysis between the independent variables (Comprehensive Scope Planning, Comprehensive Budget Planning, and Comprehensive Risk Management Planning) and success of the Nzove Water Supply Project in Rwanda.

A strong positive correlation of 0.828 was observed between Comprehensive Scope Planning and the Success of the Nzove Water Supply Project, significant at the 0.05 level (2-tailed) with a p-value of 0.000. This indicates that improved comprehensive scope planning is strongly associated with greater project success. The correlation highlights the significant role of comprehensive scope planning in the achievement of project objectives.

The findings align with Yetgin and Yılmaz (2022), whose research on the "One Belt, One Road Project" emphasized the importance of comprehensive planning and risk management. Their work highlights the need for strategic planning to ensure successful project outcomes, a conclusion mirrored in the Nzove Water Supply Project, where a strong positive correlation was observed between comprehensive scope planning and project success.

Comprehensive Budget Planning also demonstrated a strong positive correlation of 0.738 with the Success of the Nzove Water Supply Project, significant at the 0.05 level (2-tailed) with a p-value of 0.000. This indicates that efficient budget planning is closely linked to project success, emphasizing the importance of careful resource allocation and financial control.

The results are supported by Abdikani and Ouma (2024), whose study on budgetary allocation within NGOs in Mogadishu found that proper budget management leads to improved project performance. This aligns with the findings from the Nzove Water Supply Project, where a positive correlation between comprehensive budget planning and project success was evident, highlighting the importance of efficient resource allocation.

Additionally, a moderate positive correlation of 0.686 was found between Comprehensive Risk Management Planning and the Success of the Nzove Water Supply Project, significant at the 0.05 level (2-tailed) with a p-value of 0.000. This correlation indicates that effective risk management is strongly associated with project success, highlighting the critical role of risk identification and mitigation strategies in ensuring positive project outcomes.

The findings resonate with Rahmani (2024), who examined the relationship between scope management and project success. Rahmani emphasized the importance of clear scope definition and control to avoid delays and cost overruns. Similarly, the Nzove Water Supply Project demonstrated a moderate positive correlation between comprehensive risk management planning and project success, emphasizing the critical role of risk management in ensuring project success.

4.2.2 Regression

The multiple regression analysis was conducted to test the study hypotheses by assessing the contribution of independent variables to the dependent variable. It aims to determine the extent to which a single dependent variable can be predicted from a set of independent variables. Table 3 presents the model summary of the multiple regression analysis.

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.862[a]	.743	.737	.35024	1.383

a. Predictors: (Constant), Comprehensive Risk management planning, Comprehensive Scope planning, Comprehensive Budget planning

b. Dependent Variable: Success of Project

Source: Field data, 2025

Table 3 presents the results of the regression analysis examining the influence of Comprehensive Risk Management Planning, Comprehensive Scope Planning, and Comprehensive Budget Planning on the success of the Nzove Water Supply Project. The model shows a strong positive relationship between these factors and project success, with an R value of 0.862, indicating a significant linear association. The R-square value of 0.737 implies that 73.7% of the variance in project success can be explained by these factors. The Durbin-Watson statistic of 1.383 indicates no significant autocorrelation in the residuals, confirming the model's reliability.

The findings align with Kwena's (2024) study, which emphasized that comprehensive scope planning enhances housing project performance by managing resources and risks effectively, which is reflected in Nzove's success. Similarly, Kumar et al. (2020) highlighted that comprehensive budget planning is crucial for managing urban development costs, and Nzove demonstrated its importance in ensuring fiscal discipline and timely completion. Additionally, Mutesi (2021) focused on the role of comprehensive risk management planning in agriculture, which Nzove also showed as vital in mitigating risks and ensuring project stability. All studies highlight the significance of these planning elements in successful project outcomes.

Table 4: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.599	3	14.866	120.862	.000[b]
	Residual	15.457	126	.123		
	Total	60.056	129			

a. Dependent Variable: Success of Project

b. Predictors: (Constant), Comprehensive Risk management planning, Comprehensive Scope planning, Comprehensive Budget planning

Source: Field data, 2025

Table 4 shows the ANOVA findings for the regression model that examines the influence of Comprehensive Risk Management Planning, Comprehensive Scope Planning, and Comprehensive Budget Planning on the success of the Nzove Water Supply Project. The F-value (120.862) indicates a statistically significant association between the predictors and the dependent variable. The associated Significance (Sig.) score of 0.000 demonstrates that this relationship is highly significant, as it is much lower than the customary threshold of 0.05.

The findings align with Kwena's (2024) research, which emphasized that comprehensive project planning is vital for successful project execution. This indicates that a well-structured approach to scope and risk management enhances project performance. Nzove's results showed that comprehensive scope and risk management planning significantly influenced the success of the project. Both studies, along with the insights from Kumar et al. (2020) and Mutesi (2021), underscore the importance of detailed planning and resource management in ensuring the success of large-scale infrastructure projects.

Table 5: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.326	.169		1.929	.056		
	Comprehensive Scope planning	.579	.066	.582	8.773	.000	.467	2.140
	Comprehensive Budget planning	.174	.073	.185	2.384	.019	.335	2.986
	Comprehensive Risk management planning	.178	.069	.181	2.580	.011	.417	2.396

a. Dependent Variable: Success of Project

The adopted model for analysis was structured as follows:

$Y= \beta_0+\beta_1X_1+\beta_2X2+\beta_3X_3+\epsilon$

Hence,

Nzove Water Supply Project Success = 0.326 + 0.579(Comprehensive Scope Planning) + 0.174(Comprehensive Budget Planning) + 0.178(Comprehensive Risk Management Planning) + 0.169

Table 5 presents the coefficients for the regression model analyzing the impact of Comprehensive Scope Planning, Comprehensive Budget Planning, and Comprehensive Risk Management Planning on the success of the Nzove Water Supply Project, including the constant. The unstandardized coefficient for the constant is 0.326, indicating the baseline value of project success when all predictor variables are zero. The unstandardized coefficient for Comprehensive Scope Planning is 0.579, indicating that a one-unit increase in Comprehensive Scope Planning results in a 0.579-unit increase in project success ($\beta = 0.579$, $t = 8.773$, $P = 0.000<0.05$). The findings align with Utuje and Kwena (2024) who emphasized that Comprehensive Scope Planning significantly influences project performance. This indicates that effective scope planning is a critical factor for achieving desired project outcomes. The unstandardized coefficient in the Nzove Water Supply Project showed that an increase in Comprehensive Scope Planning leads to a notable increase in project success. Both studies highlight the essential role of scope planning in ensuring project goals are met.

The unstandardized coefficient for Comprehensive Budget Planning is 0.174, indicating that a one-unit increase in Comprehensive Budget Planning results in a 0.174-unit increase in project success ($\beta = 0.174$, $t = 2.384$, $P = 0.019<0.05$). The findings are supported by Munawwarah et al. (2023), who stressed the importance of Comprehensive Budget Planning in improving budget absorption rates and overall project performance. This indicates that while Comprehensive Budget Planning is important, its direct impact on project success in Nzove is less pronounced. The unstandardized coefficient in the Nzove Water Supply Project showed a positive but statistically insignificant relationship with project success. Both studies highlight the need for more effective budget planning to enhance project performance.

The coefficient for Comprehensive Risk Management Planning is 0.178, indicating that a one-unit increase in Comprehensive Risk Management Planning results in a 0.178-unit increase in success of the Nzove Water Supply Project, but it is not statistically significant ($\beta = 0.178$, $t = 2.580$, $P = 0.011< 0.05$). The Variance Inflation Factor (VIF) values are all below 3, indicating no multicollinearity issues. Multicollinearity exists whenever an independent variable is highly correlated with one or more of the other independent variables in a multiple regression equation. Multicollinearity is a problem because it will make the statistical inferences less reliable.

The findings resonate with Karasira and Irechukwu (2021), who highlighted the importance of Comprehensive Risk Management Planning in driving successful project implementation. This indicates that comprehensive risk management is vital for mitigating challenges and securing positive project outcomes. The unstandardized coefficient in the Nzove Water Supply Project showed a positive impact of risk management planning on project success. Both studies highlight the necessity of effective risk management to address uncertainties and achieve project goals.

Table 5 presents the findings of the hypothesis testing for the impacts of Comprehensive Scope Planning, Comprehensive Budget Planning, and Comprehensive Risk Management Planning on the success of the Nzove Water Supply Project in Rwanda. Each null hypothesis (Ho) proposes that the respective planning element does not have a significant impact on project success.

For H01, the p-value is less than 0.05, resulting in the rejection of the null hypothesis. This demonstrates that Comprehensive Scope Planning has a significant effect on the success of the Nzove Water Supply Project. For H02, the p-value is less than 0.05, leading to rejection of the null hypothesis, indicating that Comprehensive Budget Planning has a significant effect on project success. For H03, the p-value is less than 0.05, resulting in the rejection of the null hypothesis, showing that Comprehensive Risk Management Planning has a significant effect on the success of the project.

5. Conclusion and recommendations

5.1 Conclusion

This study aimed to investigate the influence of comprehensive scope planning, comprehensive budget planning, and comprehensive risk management planning on success of Nzove Water Supply Project in Rwanda. The analysis of these factors demonstrated significant relationships with project success. For comprehensive scope planning, a positive and significant impact was observed on project success ($p<0.05$), leading to the rejection of the null hypothesis. Comprehensive budget planning shows a significant effect on project success ($p<0.05$), and the null hypothesis for this variable was rejected. Comprehensive risk management planning was found to significantly affect project success ($p<0.05$), with the null hypothesis being rejected. These results highlight the importance of effective scope and risk management planning in ensuring success of Nzove Water Supply Project.

5.2. Recommendations

1. Project Managers are recommended to ensure clear documentation and regular updates of the project scope, as scope clarity is crucial for the success of the Nzove Water Supply Project.
2. Project Site Staffs should adhere to the defined scope throughout project execution to prevent deviations that may negatively impact the success of the Nzove Water Supply Project.
3. Project Managers are recommended to conduct frequent budget assessments to monitor discrepancies and ensure financial discipline, directly contributing to the success of the Nzove Water Supply Project.
4. WASAC Staffs should assist in creating and maintaining a financial control system that ensures the budget aligns with the project's objectives, ultimately supporting the success of the Nzove Water Supply Project.

5.3. Suggestions for Further Research

Future researchers should examine the effect of stakeholder engagement on success of Nzove Water Supply Project and analyze relationship between community participation and success of Nzove Water Supply Project.

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