



Influence of Project Planning Practices on Project Success: A Case of Ntaruka Hydro Power Plant Project in Nyaruguru District, Rwanda

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Abstract: Project planning practices remain a critical determinant of project success in Rwanda, particularly in sectors such as energy, infrastructure, and public development programs where efficient delivery is essential for national growth. Despite the government's strong emphasis on results-based management and strategic planning frameworks, many projects continue to experience challenges related. The general objective of this study is to examine the influence of project planning practices on project success in Rwanda with reference to Ntaruka hydro power plant project in Nyaruguru district in Rwanda. A descriptive and correlational research design with a quantitative approach was used. The target population consisted of 279 project stakeholders, from which universal sampling was applied. Data were collected using structured questionnaires and documentation and analyzed using descriptive statistics. Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0 to perform descriptive analysis, Pearson correlation, and multiple linear regression. The results showed significant positive effects of project resource planning ($\beta = 0.159$, $t = 4.297$, $p < 0.05$), project risk mitigation planning ($\beta = 0.472$, $t = 10.977$, $p < 0.05$), stakeholder planning ($\beta = 0.189$, $t = 5.250$, $p < 0.05$), and monitoring and evaluation planning ($\beta = 0.142$, $t = 3.087$, $p = 0.002$) on project success at Ntaruka hydro power plant project in Nyaruguru district. The study concluded that coordinated planning across resources, risks, stakeholders, and monitoring arrangements strengthened project success. It is recommended that project management sustain integrated planning reviews and act promptly on emerging implementation evidence.

Keywords: Project Planning Practices, Project Success, Resource Planning, Project Risk Mitigation Planning, Stakeholder Planning, Monitoring and Evaluation Planning

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1. Introduction

Project planning practices in the United States are extensively institutionalized across sectors such as energy, construction, and information technology, with a strong emphasis on structured planning frameworks. Project resource planning is commonly supported through advanced budgeting systems and skilled workforce allocation, while risk mitigation planning is integrated into project lifecycle management to address uncertainties early. Stakeholder planning is highly formalized, ensuring alignment among investors, regulators, and communities. Monitoring and evaluation

planning is supported through performance dashboards and data analytics, enabling real-time tracking of project progress. These comprehensive planning practices have significantly enhanced project success, which is measured through timely completion, cost efficiency, quality outputs, and long-term sustainability (Kerzner, 2022).

Singapore demonstrates highly advanced and technology-driven project planning practices, particularly within infrastructure and urban development initiatives. Resource planning is optimized through precise forecasting and efficient allocation of limited resources. Risk mitigation planning is proactive and data-driven, enabling early response to potential

disruptions. Stakeholder planning emphasizes collaboration among government agencies, private sector actors, and the public, ensuring alignment of interests. Monitoring and evaluation planning is supported by digital systems that track key performance indicators in real time. These practices have resulted in high levels of project success, reflected in efficiency, innovation, and sustainability outcomes (Kusek & Rist, 2021).

Strong regulatory frameworks and an emphasis on accountability and transparency define project planning practices in the United Kingdom. Resource planning incorporates sustainability considerations, ensuring efficient use of financial and material resources. Risk mitigation planning is guided by strict compliance requirements, reducing the likelihood of project failure. Stakeholder planning is critical due to the involvement of diverse interest groups, necessitating effective communication and engagement strategies. Monitoring and evaluation planning is well established, providing continuous assessment of project performance. These practices contribute to project success by ensuring that projects meet quality standards, achieve intended objectives, and deliver long-term value (Kerzner, 2022).

Efforts to address infrastructure and energy challenges have elevated the importance of project planning practices in South Africa. Resource planning often faces constraints due to limited funding and capacity, but improvements in allocation strategies have enhanced project performance. Risk mitigation planning is increasingly emphasized to address uncertainties related to political, economic, and environmental factors. Stakeholder planning is critical due to diverse stakeholder interests and community involvement. Monitoring and evaluation planning is gradually being strengthened to improve accountability and performance tracking. These efforts have contributed to improved project success, although challenges remain in ensuring consistent application of planning practices (PMI, 2021).

Public and development project performance in Uganda has increasingly relied on the effective application of project planning practices. Resource planning is often constrained by limited financial and technical capacity, affecting project execution. Risk mitigation planning is gradually being adopted to manage uncertainties, although its application remains inconsistent. Stakeholder planning is essential in ensuring community involvement and reducing resistance to projects. Monitoring and evaluation planning is being strengthened to enhance accountability and performance measurement. Where effectively implemented, these planning practices have positively influenced project success, particularly in achieving intended outcomes and improving service delivery (Kusek & Rist, 2021).

In Rwanda, project planning practices have become central to achieving national development priorities,

particularly in infrastructure and energy sectors. Resource planning is critical due to limited financial and technical resources, requiring efficient allocation and utilization. Risk mitigation planning is essential in addressing environmental, technical, and operational uncertainties associated within projects. Stakeholder planning plays a significant role in ensuring community engagement and support, especially in rural areas. Monitoring and evaluation planning has been strengthened through institutional frameworks aimed at improving accountability and performance tracking. Despite these efforts, challenges such as resource constraints, limited risk management capacity, and gaps in stakeholder coordination continue to affect project success, highlighting the need to examine how project planning practices influence project outcomes in Rwanda (PMI, 2021).

Project planning practices continue to serve as a cornerstone of Rwanda's broader development agenda, extending into sectors such as energy, infrastructure, health, and agriculture. The government has prioritized structured planning through strategic frameworks such as Vision 2050 and the National Strategy for Transformation, which emphasize efficiency, accountability, and results-based management. Within this context, project resource planning is critical due to the country's limited financial and technical capacity, requiring careful allocation and optimization of available resources to ensure maximum output. Risk mitigation planning is also essential, particularly in managing uncertainties related to environmental factors, funding variability, and technical implementation challenges. Stakeholder planning has gained prominence as projects increasingly involve collaboration between government institutions, development partners, private sector actors, and local communities (PMI, 2021).

Project planning practices remain a critical determinant of project success in Rwanda, particularly in sectors such as energy, infrastructure, and public development programs where efficient delivery is essential for national growth. Despite the government's strong emphasis on results-based management and strategic planning frameworks, many projects continue to experience challenges related. Evidence indicates that a significant proportion of public projects in Rwanda face delays and cost overruns, with reports showing that over 40% of government funded projects experience implementation delays, while approximately 30% exceed their initial budgets due to poor planning and coordination mechanisms (RPPA, 2023).

Delays, cost overruns, and incomplete monitoring arrangements continue to reduce the efficiency of public investments and limit timely corrective action, thereby weakening project success (RPPA, 2023).

The existing literature focuses on generic construction projects in regions and Rwanda. However, none of the

previous studies focused on Ntaruka hydro power plant project in Nyaruguru district. A number of studies that were previously conducted include RPPA (2023) and RPPA (2023) hence the gap in literature on the influence of project planning practices on the performance of that project. This study needs to bridge that gap of knowledge on the same project. This study aims to create empirical assessment of how specific project planning practices namely resource planning, risk mitigation planning, stakeholder planning, and monitoring and evaluation planning influence project success, namely this project of Ntaruka hydro power plant project in Nyaruguru district.

1.1 General objective

The general objective of this study was to determine the influence of project planning practices on project success of Ntaruka hydro power plant project in Nyaruguru district.

1.2 Specific objectives

1. To evaluate the influence of project resource planning on the success of Ntaruka hydro power plant project in Nyaruguru district.
2. To examine the influence of project risk mitigation planning on the success of Ntaruka hydro power plant project in Nyaruguru district.
3. To assess the influence of stakeholder planning on the success of Ntaruka hydro power plant project in Nyaruguru district.
4. To analyze the influence of monitoring and evaluation planning on the success of Ntaruka hydro power plant project in Nyaruguru district.

2. Literature Review

2.1 Theoretical Review

The theoretical review presents the scholarly models and conceptual frameworks that provide the underlying logic for the relationship between planning and success. This study is anchored on well-established management and project theories that explain how project planning practices influence project success.

2.1.1 Resource-Based View (RBV) Theory

The Resource-Based View Theory was developed by Jay Barney in 1991, who argued that organizational performance depends on the effective utilization of internal resources that are valuable, rare, inimitable, and non-substitutable. The theory explains that organizations achieve superior performance when they efficiently

manage their internal capabilities and resources. In project environments, this translates into how well financial, human, and material resources are planned and utilized to achieve project objectives (Barney, 2022).

Resource-Based View theory therefore supports this research by explaining that projects with strong resource planning practices are more likely to achieve success in terms of timely completion, cost control, and quality outcomes. It highlights that internal resource capabilities are a major determinant of project performance and sustainability.

2.1.2 Stakeholder Theory

Stakeholder Theory was developed by R. Edward Freeman in 1984, emphasizing that organizations must consider the interests and influence of all stakeholders in their operations. The theory argues that success is not only determined by internal efficiency but also by how well an organization manages relationships with stakeholders such as communities, government agencies, investors, and project beneficiaries (Freeman et al., 2021).

Stakeholder Theory supports the research by demonstrating that effective stakeholder planning enhances collaboration, reduces conflicts, and increases project acceptance and sustainability. It provides a framework for understanding how stakeholder engagement contributes to project success beyond technical and financial factors.

2.1.3 Goal Setting Theory

Goal Setting Theory, developed by Locke in 1968, explains that specific and challenging goals lead to higher levels of performance compared to vague or easy goals. In the context of this study, project planning practices are closely linked to goal setting, as planning involves defining clear objectives, setting targets, and establishing performance indicators. Monitoring and evaluation planning, in particular, is grounded in this theory as it focuses on tracking progress toward defined goals (Locke, 1968).

Goal Setting Theory is relevant to this study as it explains how clearly defined objectives and performance indicators contribute to project success. Projects with well-established goals and effective monitoring systems are more likely to achieve their intended outcomes. The theory therefore supports the relationship between monitoring and evaluation planning and project success.

2.2 Empirical Review

The empirical review summarizes findings from previous studies to provide a historical and global context for the research objectives. Each review presents a summary of a study including the author, objective,

methodology, key findings, and specific recommendations.

2.2.1 Project Resource Planning and Project Success

Batamuriza and Dushimimana (2024) examined the influence of resource planning on performance of the new maternity project at King Faisal Hospital in Kigali, Rwanda. The study aimed to determine how human resource planning, material resource planning, financial resource planning, and time planning affect project performance. Using a quantitative case study design, the authors found a strong overall relationship between the resource planning variables and project performance, with $R = .739$, $R^2 = .547$, adjusted $R^2 = .537$, and $F = 53.902$, $p < .001$. At coefficient level, human resource planning had the strongest positive effect ($B = .538$, $t = 6.896$, $p < .001$), followed by material resource planning ($B = .243$, $t = 2.792$, $p = .006$), financial resource planning ($B = .237$, $t = 3.645$, $p < .001$), and time planning ($B = .201$, $t = 2.092$, $p = .037$). The study recommended stronger budgeting, better staffing decisions, timely material provision, and tighter time planning to improve project success.

Mirembe (2023) studied the effect of project resource planning on performance of the Feed the Future Rwanda Hinga Weze Project in Kayonza District. The objective was to establish the effect of human, financial, material, and time resource planning on project performance. The study used correlation and multiple regression analysis and found that the model explained 68.0% of variation in performance ($R = .825$, $R^2 = .680$, adjusted $R^2 = .657$, $F = 42.016$, $p < .001$). Human resource planning was significant and positive ($B = .322$, $t = 6.238$, $p < .001$), material resource planning was also significant ($B = .135$, $t = 3.577$, $p < .001$), and time resource planning was significant ($B = .301$, $t = 8.042$, $p < .001$), while financial resource planning was not statistically significant ($B = .055$, $t = 1.083$, $p = .280$). The study recommended strengthening people planning, materials planning, and schedule planning, while improving financial planning practices so they translate more clearly into project results.

2.2.2 Project Risk Mitigation Planning and Project Success

Niragire and Kwena (2024) assessed the effect of project risk management on success of community-based projects in Burera District, Rwanda, using the Peer Driven Change Project as a case. The objective was to evaluate the effect of risk identification, risk analysis, risk control, and contingency planning on project success. The article page confirms a descriptive and correlational design focused specifically on how risk-management practices shape project success in the Burera case. The abstract reports that project success in the district was significantly affected by execution of project risk-management strategies, showing that risk

mitigation planning was central to success in the studied project. The authors recommended stronger risk-management systems, better contingency planning, and integration of risk-management practices across project phases to improve success of community-based initiatives.

Rufus and Dushimimana (2025) examined the effect of project risk management on success of the Itunda-Busanza road construction project in Kicukiro District, Rwanda. The objective was to test the effects of risk identification, risk analysis, risk response, and risk monitoring and evaluation on project success. The regression model was extremely strong, with $R = .986$, $R^2 = .972$, adjusted $R^2 = .972$, showing that the risk-management predictors explained 97.2% of the variance in project success. On descriptive measures, risk response recorded a high overall mean of 4.20 with $SD = 0.79$, while project success itself had an overall mean of 4.12 with $SD = 0.84$. The study recommended systematic use of risk avoidance, risk acceptance, mitigation, transfer, and continuous risk monitoring to sustain success in road projects.

2.2.3 Stakeholder Planning and Project Success

Wango et al. (2025) examined stakeholder identification and performance of World Bank funded projects in Kenya. The objective was to investigate whether stakeholder identification influences project performance and whether project environment moderates that relationship. The study used quantitative analysis and found that stakeholder identification had a strong positive and significant effect on performance, with $B = 0.822$, $\beta = 0.824$, $t = 15.726$, $p = 0.000$. The model also explained a substantial share of project performance, with $R^2 = 0.679$ and $F = 247.318$, $p < 0.001$. The study recommended systematic stakeholder identification at project inception because it materially improves performance outcomes.

Mukakarisa and Njoroge (2024) examined the effect of stakeholders' engagement on performance of construction projects in Rwanda using Horizon Construction Company as the case. The objective was to assess how stakeholder engagement in planning, implementation, and monitoring affects project performance. The study used mixed methods within descriptive and correlational designs. The regression results showed a strong model fit, with $R^2 = 0.754$ and $F = 112.247$, $p = 0.000$, while stakeholder engagement in project planning had a positive and significant coefficient of $\beta = 0.325$, $t = 6.153$, $p = 0.000$. The study concluded that stronger stakeholder planning improves construction project performance and recommended deeper stakeholder involvement from the planning stage onward.

2.2.4 Monitoring and Evaluation Planning and Project Success

Moussa and Akims (2024) examined the effect of monitoring and evaluation practices on performance of construction projects in Gasabo District, Rwanda. The objective was to assess how M&E planning, M&E staff skills, and M&E ICT management affect project performance. Using a descriptive design and multiple regression, the study found the overall model significant at $F(3,259) = 36.890$, $p < .001$. The coefficient results showed that M&E planning had a positive significant effect on project performance with $\beta = 0.170$, $t = 2.080$, $p < .001$, while M&E ICT management had an even stronger effect. The study recommended strengthening formal M&E planning and digital M&E systems to improve construction project success.

Uwibambe and Njenga (2025) studied monitoring and evaluation practices and performance of energy projects in Rwanda using the Electricity Access Rollout Programme. The objective was to assess the contribution of M&E planning, baseline survey implementation, and M&E information system usage to project performance. The reported results showed that M&E planning had $\beta = 0.228$, $p = 0.04$, baseline survey implementation had $\beta = 0.437$, $p = 0.020$, while M&E information system usage was not significant at $\beta = -0.54$, $p = 0.74$. The study recommended strengthening practical M&E planning and baseline systems while improving the usability of M&E information systems to enhance energy project performance.

3. Methodology

3.1 Research Design

A descriptive and correlational research design with a quantitative approach was used. The design is appropriate because it enables the researcher to systematically describe the characteristics, behaviors, and perceptions of respondents regarding the study variables without manipulating them. It also allows for the collection of standardized data that can be summarized using statistical measures such as means and standard deviations to understand the general trends in project planning practices and project success. A correlational research design is used to examine the nature and strength of relationships between variables without establishing cause-and-effect relationships, enabling the researcher to determine whether and how variables are associated. In this study, the correlational design helped analyze the relationship between project planning practices and project performance.

3.2 Study Population

In this study, the population comprised all key stakeholders involved in the planning, implementation,

and management of projects related to the study context. This study had a total of 279 employees and stakeholders. This population was classified into different categories by the researcher so that all the operating levels could be represented in the research.

3.3 Sampling Design

The sampling design describes the procedures and techniques that was used to select a representative subset of respondents from the total study population. In this study, the total population consists of 279 individuals, including project managers, engineers, supervisors, finance officers, local leaders and beneficiaries involved in project planning and implementation. The researchers performed census strategy whereby the entire 279 respondents identified was surveyed. Therefore, there was no application of sampling technique as the whole population engaged in Ntaruka hydro power plant project was universally used during the study.

3.4 Data Collection Instrument

This study employed structured questionnaires as the primary data collection instrument. It consisted of closed-ended questions designed using a Likert scale (1-5) ranging from strongly disagree to strongly agree. The questionnaire was divided into sections corresponding to the study variables, including project resource planning, project risk mitigation planning, stakeholder planning, monitoring and evaluation planning, and project success. This structure ensures that each variable is measured systematically using clearly defined indicators. Documentation play role as critical examination of available reports of the project, contracts, audit report and financial documentation to source secondary data because they record of the projects.

Relevant project documents such as project reports, planning documents, monitoring and evaluation reports, and financial records was reviewed to support and validate the primary data. This helps to triangulate findings and improve the credibility of the study by providing additional evidence on project planning practices and performance outcomes.

3.5 Pilot Study, Validity and Reliability

A pilot study was conducted prior to the main data collection to test the reliability, validity, and clarity of the research instruments. This process helps to improve the quality of data collection and ensures that the instruments effectively measure the intended variables.

The pilot study was carried out using 10% of the universal population, which is considered adequate for pre testing research instruments. Since the population of the study is 279 respondents, the pilot study involved approximately 28 selected as similar to the project. The

pilot study was conducted in Mushishito-Rukarara V Hydropower Project in Nyamagabe District, the researcher has easier access to respondents involved in similar infrastructure and development projects.

Validity ensures that the instrument measures the intended concepts, while reliability ensures consistency in measurement. Through expert review, pilot testing, CVI computation, and Cronbach's Alpha analysis, the study ensured that the instruments are both valid and reliable for data collection. The study further applied the Content Validity Index (CVI) to quantify the validity of the instrument. Experts rated each item based on its relevance, and the CVI was calculated using the formula.

The Content Validity Index of 0.86 was obtained from 25 relevant questionnaire statements out of 29 total items. The total included the 25 statements in the variable tables and four demographic categories. As the CVI was above the acceptable value of 0.70, the questionnaire had good content validity and was considered appropriate for measuring the study variables.

A Cronbach's Alpha value of 0.70 or higher was considered acceptable, indicating that the instrument is reliable. Values above 0.80 indicated good reliability, while values above 0.90 indicated excellent reliability. If any variable records Cronbach's Alpha value below 0.70, the researcher reviewed and revise or remove inconsistent items to improve reliability.

Table 1: Reliability Statistics

Variable	Number of items	Cronbach's Alpha	Decision
Project resource planning	5	0.826	Reliable
Project risk mitigation planning	5	0.841	Reliable
Stakeholder planning	5	0.819	Reliable
Monitoring and evaluation planning	5	0.848	Reliable
Project success	5	0.837	Reliable
Overall questionnaire	25	0.834	Reliable

The Cronbach's Alpha coefficients ranged from 0.819 to 0.848, which were all above 0.70. The questionnaire therefore had good internal consistency and was reliable for the study.

3.6 Data Analysis

Data analysis refers to the process of systematically applying statistical techniques to describe, summarize, and interpret the collected data in order to answer the research objectives and test the relationships between variables.

All the indicators were subject to the linear regression model according to the conceptual framework to analyze the effect of project planning practices on project success. The regression equation was given as:

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

Where: Y = Project Success

X₁ = Project Resource Planning

X₂ = Project Risk Mitigation Planning

X₃ = Stakeholder Planning

X₄ = Monitoring and Evaluation Planning

β₀ = Constant

β₁–β₄ = Regression coefficients

ε = Error term

3.7 Ethical Considerations

The researcher exercised strict practice of Informed Consent whereby the researcher informed all the participants of the objective of the study then they signed the consent form. Confidentiality and Privacy also was considered by securing all the collected data and using it in an academic manner. Personal information such as names and positions were not disclosed in the final report. Data collected was used strictly for academic purposes and was not shared with unauthorized individuals. Codes or identifiers was used instead of names to protect respondents' identities. The researcher sought official permission from relevant authorities before conducting the study.

4. Results and Discussion

4.1 Response Rate

Response rate shows the extent to which selected respondents participated in a study. It is important because sufficient participation improves confidence that the collected data reasonably represent the views of the intended respondents. In this study, the response rate was assessed using the number of complete, incomplete, and unreturned questionnaires from participants connected to Ntaruka hydro power plant project in Nyaruguru district.

Table 2: Response Rate

Questionnaires	Frequency	Percentage (%)
Returned Complete	258	92.5
Returned Incomplete	8	2.9
Unreturned	13	4.7
Total	279	100.0

Source: Primary data (2026)

The findings in Table 2 indicate the response rate for the study of project planning practices and project success at Ntaruka hydro power plant project in Nyaruguru district. Complete questionnaires were obtained from 258 respondents, equivalent to 92.5%, which provided a strong basis for the planned analysis. Eight questionnaires, representing 2.9%, were incomplete and were not included in the analysis, while 13 questionnaires, representing 4.7%, were not returned. The high proportion of complete responses reduced the likelihood that non-response would materially affect the study results.

4.2 Correlation Analysis

Correlation analysis was applied to determine the direction, strength, and statistical significance of the relationship between each planning practice and project success. The analysis used Pearson's correlation coefficient and a 0.05 significance level, with attention limited to the four relationships specified in the study objectives.

Table 3: Correlations

		Project resource planning	Project risk mitigation planning	Stakeholder planning	Monitoring and evaluation planning	Project success
Project resource planning	Pearson Correlation	1	.593**	.662**	.678**	.709**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	258	258	258	258	258
Project risk mitigation planning	Pearson Correlation	.593**	1	.620**	.739**	.825**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	258	258	258	258	258
Stakeholder planning	Pearson Correlation	.662**	.620**	1	.760**	.755**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	258	258	258	258	258
Monitoring and evaluation planning	Pearson Correlation	.678**	.739**	.760**	1	.795**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	258	258	258	258	258
Project success	Pearson Correlation	.709**	.825**	.755**	.795**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	258	258	258	258	258

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

Source: Primary data (2026)

The findings in Table 3 indicate the Pearson correlations between the four project planning practices and project success at Ntaruka hydro power plant project in Nyaruguru district.

Project resource planning had a strong positive relationship with project success ($r = 0.709$, $p = 0.000$). Since the p-value was below 0.05, the relationship was statistically significant. This means that stronger

planning of budgets, people, materials, and equipment was associated with higher project success.

The relationship between resource planning and project success is supported by Andinda (2023), whose infrastructure study showed that deliberate staffing, financial preparation, and materials and equipment allocation improve project performance. The study is relevant to Ntaruka hydro power plant project because careful resource planning helps technical work proceed with fewer interruptions, strengthens accountability for

resource use, and supports the completion of planned activities in a reliable manner.

Project risk mitigation planning showed a very strong positive relationship with project success ($r = 0.825$, $p = 0.000$). The p-value was below 0.05, confirming that the relationship was statistically significant. This indicates that better identification, analysis, monitoring, prioritisation, and response to risks were associated with greater project success.

The relationship between risk mitigation planning and project success is supported by Omondi and Muchelule (2022), who found that formal risk management practices strengthened the performance of Kenya Rural Roads Authority projects. Their study reinforces the current interpretation because identifying risks, analysing their possible effects, and acting before they escalate help project teams protect schedules, resources, technical quality, and the continuity of planned operations.

Stakeholder planning had a strong positive and statistically significant relationship with project success ($r = 0.755$, $p = 0.000$). The result shows that effective stakeholder identification, participation, communication, feedback, and conflict resolution were associated with improved success of the Ntaruka hydro power plant project. The p-value below 0.05 confirms that this relationship was not due to chance.

The association between stakeholder planning and project success is consistent with Wango et al. (2025), who demonstrated that systematic stakeholder identification supports the performance of World Bank funded projects. Their study confirms the importance of recognising stakeholder influence early, communicating clearly, and creating channels for participation. These practices help a project obtain cooperation, manage

expectations, and reduce the risk that unresolved concerns will undermine its implementation.

Monitoring and evaluation planning was strongly and positively related to project success ($r = 0.795$, $p = 0.000$). The p-value was below 0.05, so the relationship was statistically significant. This suggests that clear indicators, timely evaluation, feedback use, corrective action, and adequate M&E support were associated with better project success.

The connection between monitoring and evaluation planning and project success accords with Ayoma and Abuga (2023), who associated effective surveillance, implementation monitoring, and relevant evaluation with improved project performance. Their evidence is applicable to the Ntaruka hydro power plant project because dependable performance information supports learning, enables managers to detect gaps early, and guides corrective decisions that preserve the quality and continuity of operations.

All four planning practices had positive and statistically significant relationships with project success at Ntaruka hydro power plant project. The evidence shows that project success was closely associated with coordinated planning of resources, risks, stakeholders, and monitoring arrangements.

4.3 Regression Analysis

Multiple regression analysis was used to examine the combined and individual influence of project resource planning, project risk mitigation planning, stakeholder planning, and monitoring and evaluation planning on project success. The model summary assessed the strength and explanatory power of the model, the ANOVA table tested the overall model significance, and the coefficients table identified the contribution of each planning practice while checking collinearity.

Table 4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.897 ^a	.805	.802	.171794	1.721
a. Predictors: (Constant), Monitoring and evaluation planning, Project resource planning, Project risk mitigation planning, Stakeholder planning					
b. Dependent Variable: Project success					

Source: Primary data (2026)

The results in Table 4 indicate the model summary for the influence of project planning practices on project success at Ntaruka hydro power plant project in Nyaruguru district. The multiple correlation coefficient of $R = 0.897$ showed a very strong positive association between the combined planning practices and project success. The R Square value of 0.805 indicated that 80.5% of the variation in project success was explained by project resource planning, project risk mitigation

planning, stakeholder planning, and monitoring and evaluation planning. The adjusted R Square of 0.802 showed that the explanatory power remained strong after accounting for the number of predictors. The Durbin-Watson value of 1.721 was close to 2.0, indicating that the residuals did not show a problematic autocorrelation pattern.

The strength of the combined planning model is supported by Tuyisenge and Kabanda (2023), who found

that project planning practices meaningfully explained performance in agriculture projects in Rwanda. Their study highlights the value of treating planning as an integrated management process rather than as separate

activities. This perspective supports the current study because coordinated resource, risk, stakeholder, and monitoring plans can work together to improve delivery conditions.

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.913	4	7.728	257.600	.000 ^b
	Residual	7.467	253	.030		
	Total	38.380	257			

a. Dependent Variable: Project success

b. Predictors: (Constant), Monitoring and evaluation planning, Project resource planning, Project risk mitigation planning, Stakeholder planning

Source: Primary data (2026)

The findings in Table 5 indicate the ANOVA results for the regression model explaining project success at Ntaruka hydro power plant project in Nyaruguru district. The model produced an F-statistic of 257.600, which showed that the regression model provided a strong overall fit to the data. Its significance value of 0.000 was below the 0.05 threshold. The combined influence of

project resource planning, project risk mitigation planning, stakeholder planning, and monitoring and evaluation planning on project success was therefore statistically significant. This means that the model was suitable for explaining project success in the project setting.

Table 6: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.171	.131		1.305	.193		
Project resource planning	.159	.037	.173	4.297	.000	.478	2.093
Project risk mitigation planning	.472	.043	.459	10.977	.000	.435	2.300
Stakeholder planning	.189	.036	.234	5.250	.000	.380	2.632
Monitoring and evaluation planning	.142	.046	.160	3.087	.002	.288	3.468

a. Dependent Variable: Project success

Source: Primary data (2026)

The results in Table 6 indicate the individual influence of each project planning practice on project success at Ntaruka hydro power plant project in Nyaruguru district.

Project resource planning had a positive coefficient of B = 0.159, meaning that a one-unit increase in project resource planning would increase project success by 0.159 units when the other variables were held constant. The t-value of 4.297 and p-value of 0.000 showed that this influence was statistically significant at the 0.05 level. The tolerance value of 0.478 and VIF of 2.093 showed no problematic multicollinearity. The null hypothesis that project resource planning has no significant influence on project success was rejected.

The influence of project resource planning is supported by Batamuriza and Dushimimana (2024), who found that deliberate resource planning enhanced project performance in Rwanda. Their study emphasises that

effective deployment of people, materials, time, and finances creates a practical foundation for implementation. This supports the current conclusion that resource planning at Ntaruka hydro power plant project should remain a continuous management responsibility rather than a one-time planning task.

Project risk mitigation planning had a positive coefficient of B = 0.472, implying that a one-unit increase in project risk mitigation planning would increase project success by 0.472 units while other factors remained constant. The t-value of 10.977 and p-value of 0.000 established that this was a statistically significant influence at the 0.05 level. Its tolerance of 0.435 and VIF of 2.300 showed that multicollinearity was not a concern. The null hypothesis that project risk mitigation planning has no significant influence on project success was rejected.

The contribution of project risk mitigation planning concurs with Rufus and Dushimimana (2025), who

established that risk-management practices strengthened project success in a Rwandan road construction project. Their study confirms that systematic risk work can protect project delivery from uncertainty by directing attention to threats before they damage performance. The present study similarly demonstrates the importance of active risk management within the hydropower project environment.

Stakeholder planning produced a positive coefficient of $B = 0.189$, indicating that a one-unit increase in stakeholder planning would increase project success by 0.189 units when other variables were controlled. The t-value of 5.250 and p-value of 0.000 confirmed a statistically significant influence at the 0.05 level. The tolerance value of 0.380 and VIF of 2.632 indicated acceptable collinearity statistics. The null hypothesis that stakeholder planning has no significant influence on project success was rejected.

The influence of stakeholder planning agrees with Mukakarisa and Njoroge (2024), who found that engagement in planning improved construction project performance in Rwanda. Their work stresses that project managers should create meaningful relationships with affected groups and incorporate their concerns into decisions. This is relevant to Ntaruka hydro power plant project because cooperation with communities, authorities, and other stakeholders can protect project acceptance and sustain expected benefits.

Monitoring and evaluation planning had a positive coefficient of $B = 0.142$, showing that a one-unit increase in monitoring and evaluation planning would increase project success by 0.142 units, with the other variables held constant. The t-value of 3.087 and p-value of 0.002 showed that this influence was statistically significant at the 0.05 level. Its tolerance value of 0.288 and VIF of 3.468 remained within acceptable limits, indicating no serious multicollinearity problem. The null hypothesis that monitoring and evaluation planning has no significant influence on project success was rejected.

The influence of monitoring and evaluation planning resonates with Uwibambe and Njenga (2025), who

identified monitoring and evaluation planning as a positive contributor to energy project performance in Rwanda. Their study highlights the practical value of organised performance information, review, and follow-up. It supports the present implication that Ntaruka hydro power plant project should retain strong monitoring arrangements so operational decisions continue to be based on evidence and learning.

The adopted model for analysis was structured as follows:

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

Where Y = Project success; X_1 = Project resource planning; X_2 = Project risk mitigation planning; X_3 = Stakeholder planning; X_4 = Monitoring and evaluation planning; β_0 = constant; β_1 - β_4 = regression coefficients; and ε = error term.

The estimated regression equation was:

$$\text{Project success} = 0.171 + 0.159(\text{Project resource planning}) + 0.472(\text{Project risk mitigation planning}) + 0.189(\text{Stakeholder planning}) + 0.142(\text{Monitoring and evaluation planning}) + \varepsilon$$

Thus, all four planning practices made positive and statistically significant contributions to project success. Project risk mitigation planning made the largest unique contribution, followed by stakeholder planning, project resource planning, and monitoring and evaluation planning. The acceptable tolerance and VIF values further showed that the predictors could be interpreted reliably within the model.

4.4 Decision on Null Hypotheses

This section presents the decision on each null hypothesis using the coefficient significance values at the 0.05 level. A null hypothesis was rejected where the corresponding p-value was less than 0.05 and retained where the p-value was greater than or equal to 0.05.

Table 7: Decision on Null Hypotheses

Null Hypothesis	p-value	Decision
H₀₁: Project resource planning has no significant influence on the success of Ntaruka hydro power plant project in Nyaruguru district.	.000	Rejected
H₀₂: Project Risk mitigation planning has no significant influence on the success of Ntaruka hydro power plant project in Nyaruguru district.	.000	Rejected
H₀₃: Stakeholder planning has no significant influence on the success of Ntaruka hydro power plant project in Nyaruguru district.	.000	Rejected
H₀₄: Monitoring and evaluation planning has no significant influence on the success of Ntaruka hydro power plant project in Nyaruguru district.	.002	Rejected

Source: Primary data (2026)

The findings in Table 7 indicate the decisions on the four null hypotheses for Ntaruka hydro power plant project in

Nyaruguru district. Ho1 was rejected because project resource planning had a statistically significant influence on project success. Ho2 was rejected because project risk

mitigation planning significantly influenced project success. Ho3 and Ho4 were also rejected because stakeholder planning and monitoring and evaluation planning each had statistically significant influences on project success. The hypothesis decisions confirm that project planning practices were important predictors of project success in the study context.

5. Conclusions and Recommendations

5.1 Conclusions

Project resource planning positively influenced the success of Ntaruka hydro power plant project in Nyaruguru district. Effective allocation of financial, human, material, and equipment resources supported smooth project operations and strengthened the capacity to achieve planned outcomes. The study therefore concludes that resource readiness and disciplined utilisation are essential to maintaining project success.

Project risk mitigation planning had a positive influence on the success of Ntaruka hydro power plant project in Nyaruguru district. Systematic identification, analysis, prioritisation, monitoring, and response to risks enabled the project to manage potential disruptions before they affected project delivery. The study concludes that risk mitigation planning is a central driver of sustained project success in the hydropower context.

Stakeholder planning positively influenced the success of Ntaruka hydro power plant project in Nyaruguru district. Meaningful identification, participation, communication, feedback, and fair conflict resolution encouraged stakeholder understanding and support. The study concludes that stakeholder planning is vital for maintaining cooperation and protecting project outcomes.

Monitoring and evaluation planning positively influenced the success of Ntaruka hydro power plant project in Nyaruguru district. Clear indicators, timely assessments, feedback use, corrective action, and budget support strengthened informed management decisions throughout project operations. The study concludes that a functional monitoring and evaluation plan is necessary for keeping the project aligned with its intended results.

Project planning practices positively influenced project success at Ntaruka hydro power plant project in Nyaruguru district. The project's success depended on the combined application of resource planning, risk mitigation planning, stakeholder planning, and monitoring and evaluation planning rather than isolated management actions. Integrated planning strengthened operational preparedness, stakeholder support, accountability, and the ability to respond to emerging needs. Continued attention to these interrelated practices

is therefore important for preserving the project's relevance, efficiency, impact, and sustainability.

5.2 Recommendations

The following recommendations are based on the findings and conclusions of the study. They are directed to project management, Nyaruguru district authorities, technical staff, and stakeholders involved in the continued operation and management of Ntaruka hydro power plant project.

1. Project management should maintain a rolling resource plan that links budget releases, staffing needs, materials, and equipment use to the operational schedule.
2. The project should give priority to risk mitigation planning by maintaining an updated risk register that assigns each major risk to a responsible officer.
3. Project management should strengthen contingency arrangements for high-priority risks, including alternative supplies, emergency technical support, and clear escalation procedures.
4. The project should maintain transparent procedures for receiving, recording, and resolving stakeholder concerns.
5. Project management should continue to use clear performance indicators and timely evaluation reports in routine decision-making.
6. Nyaruguru district authorities should support coordination between the project and relevant local institutions to sustain benefits for surrounding communities.

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