JRIIE Journal of Research Innovation and Implications in Education
Center for Research Implications & Practice
Website: www.jriiejournal.com ISSN 2520-7504 (Online) Vol.10, Iss.3, 2026 (pp. 2683 - 2695)

# Effect of Project Planning Practices on Performance of Mining Projects: A Case of Bugarama Wolfram Mining Project in Burera District, Rwanda

Jean Bertrand and Aristide Micomyiza
University of Kigali
https://orcid.org/0009-0004-0934-486X
Email: micomyizajeanbertrandaristide@gmail.com

**Abstract**: This study examined the effect of project planning practices on performance of Bugarama Wolfram Mining Project in Burera District, Rwanda. Project resource planning, risk mitigation planning, stakeholders engagement planning, and monitoring and evaluation planning were assessed as predictors of project performance. Resource-Based View Theory, Complexity Theory, Stakeholder Theory, and Theory of Constraints guided the study. Descriptive and correlational research designs were adopted using quantitative and qualitative approaches. The target population comprised 189 project actors, all of whom were included through a census approach; 181 complete questionnaires were returned, representing a 95.8% response rate. Questionnaires, interviews, and documentation generated the study data, while the complete questionnaires were analysed using SPSS version 29 through descriptive statistics, Pearson correlation, and multiple linear regression. Regression results showed positive and statistically significant effects for project resource planning (B = 0.326; t = 6.792; p = 0.000), risk mitigation planning (B = 0.118; t = 2.622; p = 0.010), stakeholders engagement planning (B = 0.265; t = 6.310; p = 0.000), and monitoring and evaluation planning (B = 0.143; t = 3.043; p = 0.003). The model explained 95.3% of variation in project performance. The study concluded that integrated planning practices strengthened mining project performance and recommended coordinated resource schedules, active risk registers, structured stakeholder engagement, and results-based monitoring systems.

Keywords: Project Resource Planning, Risk Mitigation Planning, Stakeholders Engagement Planning, Monitoring and Evaluation Planning, Project Performance.

**How to cite this work (APA):**

Bertrand, J. and Micomyiza, A. (2026). Effect of Project Planning Practices on Performance of Mining Projects: A Case of Bugarama Wolfram Mining Project in Burera District, Rwanda. *Journal of Research Innovation and Implications in Education, 10*(3), 2683 – 2695. **https://doi.org/10.59765/hdr7d3**

## 1. Introduction

Project planning practices matter to the performance of mining projects since they are the way in which resources, risks, stakeholder relations, monitoring systems and priorities for implementation are organized in the effort to turn mineral deposits into productive operations. The mining projects are subject to technical, financial, environmental and market uncertainty, and poor planning disrupts extraction, raises costs, slows down the timelines and degrades the output quality. Good planning will hence offer a systematic foundation for resourcing development, foreseeing problem areas, and for checking performance levels against planned results (Igharo & Osazevbaru, 2024).

Mining projects are examples of the need for integrated planning under various operating conditions. In Norway, project performance more and more involves a mix of technical efficiency and environmental protection along with continued social acceptance (Sjøveian & Lindstøl, 2023). In the United States, critical-minerals projects have embraced digital-twin technologies and the early identification of geological risks in order to enhance operational control (Mayer et al., 2022), whilst in China, the concept of a green mine has been tied to technological modernization, safety, productivity and recovery of mineral resources (Zhang & Li, 2023). The nickel processing plant in Indonesia also demonstrates that logistics, coordination of investors, management of contractors, and government relations contribute to the

operational capacity of the processing plant within a planned time frame and cost.

Africa is experiencing similar performance pressures to mining and extractive projects to those in Latin America, but in different resource and institutional contexts. Integrated value-chain planning has been adopted in Morocco for more efficient mineral processing and transport (El Amri & Belhadi, 2022). The evidence from Ghanaian mining suggests that working conditions, community relations, and local content requirements all impact project timelines and project results (Agyekum et al., 2022). In Kenya, extractive-industry projects are still reliant on structured monitoring frameworks to support implementation control (Mutua & Nzulwa, 2023), and in Tanzania, mining projects continue to see cost control, specialized equipment, technical capability and regulatory compliance as the key performance conditions (Mrosso & Mwakujonga, 2024).

Rwanda's mining industry has gradually evolved from artisanal to more organized and semi-mechanized operations. Technical oversight, resources planning, safety, traceability and recovery efficiency, is a new trend that is now associated with the performance of a mining project (Mukunzi & Mulyungi, 2022). Investments in tin, tungsten and tantalum have continued to grow in various districts, and the Rwanda Mines, Petroleum and Gas Board has continued to work on the traceability and professionalization of mining activities (Rwanda Mines, Petroleum and Gas Board, 2023). The Bugarama Wolfram Mining Project is an appropriate setting for examining the influence of planning practices on scope, cost, quality and timeliness because of these conditions.

The ongoing performance issue is still clearly visible despite an increase in revenue in the sector. Rwanda's mineral export earnings increased from USD 373 million in 2017 to USD 1.75 billion in 2024. The 2024 earnings were, however, approximately 80.6% of the USD 2.17 billion annual mineral-export goal that was set for 2029, with a shortfall of approximately USD 420 million. The mineral exports totaled USD 1.216 billion in 2023, which is approximately 81% of the planned target of USD 1.5 billion. While this amounted to USD 284 million more than in 2022 (Rwanda Mines, Petroleum and Gas Board [RMB], 2025b), it remained 22% below USD 994.9 million in 2022 (Ministry of Trade and Industry, 2024), indicating an export-performance shortfall in the sector.

The indicators of operation support the issue of performance. In 2023/2024, 18 out of 52 potential mineral areas identified for the sector review were explored (34.6%) and 34 areas (65.4%) remained to be explored (Ministry of Trade and Industry, 2024). The extraction efficiency was at about 40% and the national ambition is 80%, which equates to a gap in extraction efficiency of 40 percentage points (RMB, 2025a). In Rwanda, there were an estimated 34,000 to 65,000 directly involved in artisanal and small-scale mining (ASM), and approximately 1.1 million people depend on artisanal and small-scale mining. Data from 39 small-scale mining sites with 454 stakeholders also revealed that 50 percent of the miners used hand torches; while only 7 percent used rechargeable head torches, highlighting the persistent technology and working condition constraints (McQuilken et al., 2023).

In Rwanda and elsewhere, though, issues of mining performance, resource allocation, risk management, stakeholder relations and monitoring have been explored, but project specific evidence is limited for Bugarama Wolfram Mining Project in Burera District. The current national evidence is incomplete in its description of the interplay between project planning processes in this mining project. Therefore, the purpose of this study was to find the impact of project planning practices on the performance of the Bugaramma Wolfram mining project in Burera District in Rwanda.

## 1.1 General Objective

The general objective was to determine the effect of project planning practices on performance of Bugarama Wolfram Mining Project in Burera District, Rwanda.

## 1.2 Specific Objectives

i. The study assessed the effect of project resource planning on performance of Bugarama Wolfram Mining Project.
ii. The study analysed the effect of risk mitigation planning on performance of Bugarama Wolfram Mining Project.
iii. The study determined the effect of stakeholders engagement planning on performance of Bugarama Wolfram Mining Project.
iv. The study examined the effect of monitoring and evaluation planning on performance of Bugarama Wolfram Mining Project.

# 2. Literature Review

This section reviews theories and empirical evidence explaining project planning practices and performance of Bugarama Wolfram Mining Project.

## 2.1 Theoretical Review

The theoretical review explains the perspectives used to interpret the four planning practices. Resource-Based View Theory, Complexity Theory, Stakeholder Theory and Theory of Constraints provided the analytical foundation for the study.

### 2.1.1 Resource-Based View (RBV) Theory

Resource-Based View Theory explains organisational performance through the resources and capabilities that an organisation controls and deploys. The theory considers physical assets, financial resources, technical knowledge, human capabilities and organisational systems as potential sources of performance when they are valuable and effectively organised. Resource-based scholarship therefore places emphasis on the quality of resource combinations rather than on resource possession alone (Grant, 1991; Barney & Hesterly, 2011).

The theory suggests that project performance improves when managers identify critical resources, match them with operational requirements and coordinate their use across activities. In mining projects, machinery, explosives, skilled labour, finance, maintenance capacity and procurement systems are interdependent. Weakness in one resource category can therefore create idle time, production interruptions and cost pressure, while coordinated allocation can strengthen operational efficiency and continuity (Lopes & Banaitienė, 2024; Perrier, 2021).

Resource-Based View Theory was applied to project resource planning to explain how equipment scheduling, material procurement, skills assessment and allocation of financial and human resources influenced performance of Bugarama Wolfram Mining Project. The theory provided a basis for understanding how organised deployment of project resources supported scope achievement, cost control, mineral quality and timeliness.

### 2.1.2 Complexity Theory

Complexity Theory views projects as systems containing many interacting elements whose combined behaviour cannot always be predicted from individual activities. Complex projects operate through interdependencies among people, technology, resources, environmental conditions and decisions. Changes in one part of the system can therefore create wider effects across cost, schedule, quality and operational stability (Stacey, 2001).

The theory challenges rigid planning where uncertainty and interdependence are high. It emphasises adaptation, continuous information exchange and timely response because apparently minor changes may produce substantial consequences for the wider project system. Mining projects reflect this condition through geological uncertainty, equipment dependence, environmental exposure, safety requirements and market volatility, all of which can interact during implementation (Ali et al., 2022).

Complexity Theory was applied to risk mitigation planning to explain how threat identification, impact assessment, mitigation strategies and risk-register reviews supported performance of Bugarama Wolfram Mining Project. The theory clarified why proactive and adaptive risk planning was necessary to protect mining operations from interconnected geological, environmental, technical and financial disruptions.

### 2.1.3 Stakeholder Theory

Stakeholder Theory explains that projects depend on individuals and groups that can affect, or are affected by, project decisions and outcomes. Project performance is therefore linked with the ability to recognise stakeholder interests, communicate expectations, coordinate responsibilities and create value across different groups rather than focusing on one actor alone (Freeman et al., 2021).

The theory gives importance to stakeholder identification, influence analysis, consultation, communication and continuing relationship management. In mining projects, local communities, regulators, workers, project managers, technical teams and partners may hold different interests and levels of influence. Structured engagement reduces misunderstanding, strengthens legitimacy and supports cooperation where project activities affect employment, land, environmental conditions and community expectations (Bourne, 2024).

Stakeholder Theory was applied to stakeholders engagement planning to explain how stakeholder identification, analysis, communication channels and responsibility definition influenced performance of Bugarama Wolfram Mining Project. The theory helped relate planned engagement with trust, participation, conflict prevention, regulatory cooperation and continuity of mining operations.

### 2.1.4 Theory of Constraints

Theory of Constraints explains that the performance of a system is limited by one or more constraints that restrict overall throughput. Rather than attempting to optimise every activity independently, the theory directs management attention to identifying the most important bottleneck, managing it effectively and then repeating the improvement process when the limiting condition changes (Matějka, 2021).

Within project environments, constraints may arise from limited equipment, delayed information, specialised personnel, approval processes, budget restrictions or activities that control the pace of subsequent work. Monitoring becomes important because managers need reliable information to locate the current bottleneck and determine whether corrective action has improved the

wider project flow. Constraint-focused planning therefore supports timely decisions and efficient use of available capacity (Akpan & Chizea, 2023).

Theory of Constraints was applied to monitoring and evaluation planning to explain how standardised data collection, progress tracking, evaluation schedules and reporting systems identified performance bottlenecks within Bugarama Wolfram Mining Project. The theory provided a basis for understanding how monitoring evidence supported corrective action and protected the overall flow of mining operations.

## 2.2 Empirical Review

The empirical review synthesised previous evidence on project resource planning, risk mitigation planning, stakeholders engagement planning, monitoring and evaluation planning and project performance. International, African and Rwandan studies were considered according to their methods, findings and implications for mining project delivery.

### 2.2.1 Project Resource Planning and Project Performance

Evidence from construction supply chains demonstrates how digital integration can strengthen resource planning. Zhang (2023) examined digital transformation and sustainable supply-chain performance in construction, while the dissertation reported analysis of 250 construction firms using PLS-SEM. The study associated integrated resource planning and 5D Building Information Modelling with lower material wastage and improved cost performance. The evidence supports the view that resource information becomes more valuable when it is integrated across procurement, scheduling and implementation, a consideration that is relevant to equipment, materials and financial coordination in mining projects.

Uwera and Dushimimana (2025) examined project planning and performance using the PRISM Project in Rulindo District. Their study treated planning as an important contributor to implementation performance and emphasised the need for coordinated planning and stakeholder consultation. This evidence supports the argument that resource plans should not operate as isolated administrative documents; they need to connect schedules, responsibilities and implementation requirements so that available inputs can be converted into measurable project outcomes.

Dufitumukiza (2022) evaluated project planning and sustainability of agricultural market infrastructure using the Musanze Agri Market project. The dissertation reported a descriptive design involving 90 project stakeholders and a strong positive association between financial resource planning and project success. The evidence showed that transparent management of human, financial and material resources supported timely and budget-conscious implementation. This finding supports the relevance of coordinated resource deployment in projects where several activities depend on the timely availability of inputs.

A modelling perspective on resource allocation was provided by Afshari and Sobhanifard (2023), who examined the impact of resource allocation on construction performance. Their work connected project performance with the systematic matching of labour, finance, materials and equipment to activity requirements. The study supports the principle that resource shortages and poorly timed allocations can create operational interruptions and unnecessary costs. In mining projects, this evidence is particularly relevant because specialised machinery and technical personnel often serve several dependent activities, making accurate scheduling essential for maintaining production continuity.

Mining-specific Rwandan evidence was provided by Mukunzi and Mulyungi (2022), who examined project planning practices and performance of mining projects in Rwanda. Their study focused directly on a Wolfram mining setting and linked effective planning with the management of technical capabilities, financial inputs and operational resources. The evidence supports the view that mining performance depends not simply on possessing resources but on organising their deployment, maintenance and supervision around production requirements. This creates a clear empirical basis for examining project resource planning within Bugarama Wolfram Mining Project.

### 2.2.2 Risk Mitigation Planning and Project Performance

Risk-management evidence across industrial projects demonstrates the value of early preparation for uncertainty. Aven (2024) examined risk-management frameworks in project success across sectors including construction and information technology. The dissertation reported a case-based and content-analysis approach in which organisations integrating risk management into development plans were more likely to achieve successful outcomes. The study emphasised systematic identification, assessment and mitigation rather than reactive correction. This evidence supports the position that mining projects require formal risk planning before geological, environmental, safety or market threats interrupt implementation.

Construction evidence from Africa further links uncontrolled risk with project delay. Oluwafunmilola (2022) examined the global phenomenon of construction delays and the role of risk management, while the

dissertation reported survey evidence from 210 construction professionals. Failure to control technical, financial and environmental risks was identified as an important source of schedule overruns. The study supports proactive risk mitigation as a mechanism for reducing failure and protecting stakeholder expectations. This reasoning is applicable to mining because delayed recognition of operational risks can affect production, safety, cost and contractual commitments simultaneously.

Rwandan local-government evidence was provided by Eric (2021), who examined planning and infrastructure project outcomes. The dissertation reported a survey of 140 participants and identified failure to anticipate and manage risks among the causes of project overruns. Risk-aware planning, contingency management and regular risk review increased the explanatory strength of project-performance models. This evidence supports the view that risk planning needs documented responsibilities, contingency arrangements and recurring assessment rather than one-time identification. Such practices are directly relevant to the operational uncertainties affecting mining projects.

Mining-sector evidence in Rwanda also demonstrates the performance consequences of operational disruption. Habimana and Nkikabahizi (2023) examined the impact of operational disruptions on export performance in the Rwandan mining sector. Their focus connects project performance with the ability of mining operations to withstand interruptions that can affect production and market delivery. The study supports the need to identify technical, supply, environmental and operational threats before they become prolonged disruptions. This provides a mining-specific rationale for testing risk mitigation planning at Bugarama Wolfram Mining Project.

National audit evidence provides an additional perspective on unmanaged project constraints. The Office of the Auditor General (2023) reviewed the management of stalled and abandoned public projects in Rwanda. Although the report covered public projects rather than mining alone, it demonstrates the practical consequences that arise when implementation risks, constraints and corrective actions are not managed effectively. The evidence supports systematic risk registers, early escalation and clear mitigation responsibilities as mechanisms for reducing the likelihood that project difficulties develop into persistent performance failures.

### 2.2.3 Stakeholders Engagement Planning and Project Performance

Evidence from participatory project design illustrates the operational value of planned stakeholder involvement. Smith (2022) examined co-design and teacher involvement in London primary-school projects, while the dissertation reported qualitative analysis of project documents and interviews with school governors and teachers. Projects that used co-design achieved stronger implementation outcomes because professional participants contributed to decisions before implementation. Although the context differs from mining, the evidence supports the principle that people who implement or experience project decisions are more likely to support them when consultation is planned and continuous.

Project-management scholarship provides a broader basis for stakeholder planning. Freeman et al. (2021) examined stakeholder theory in the world of project management and emphasised that project value depends on balancing stakeholder interests, responsibilities and contributions. Their work supports early identification, communication and participation rather than treating stakeholder engagement as an occasional activity. This evidence is relevant to mining projects because operational continuity depends on cooperation among technical teams, workers, regulators, partners and surrounding communities whose expectations may differ across the project life cycle.

Mining evidence from Ghana highlights the connection between community conditions and project performance. Agyekum et al. (2022) examined factors influencing the performance of gold mining projects in the Tarkwa mining region. The dissertation linked project schedules with labour-market conditions, community relations and local-content requirements. The study therefore supports the view that stakeholder relationships form part of the operational environment of a mining project. Planned engagement can reduce resistance, clarify expectations and strengthen the legitimacy required for uninterrupted implementation.

Evidence from Northern Norway also demonstrates that mining performance extends beyond technical production. Sjøveian and Lindstøl (2023) examined Arctic mining performance and the balance between environmental planning and operational efficiency. Their analysis emphasised continued social acceptance alongside technical capability in high-cost mining environments. This evidence supports structured engagement with communities, regulators and environmental stakeholders because project continuity may depend on maintaining trust and responding to concerns before they become operational constraints.

Rwandan evidence on project planning further supports the role of stakeholder coordination. Uwera and Dushimimana (2025) examined project planning and project performance in the PRISM Project in Rulindo District and highlighted consultation as part of effective planning. The study supports the view that stakeholder planning should connect communication, participation and responsibility with implementation decisions. This is

relevant to Bugarama Wolfram Mining Project because local leaders, partners, project teams and surrounding communities influence the social and institutional conditions under which mining activities are implemented.

### 2.2.4 Monitoring and Evaluation Planning and Project Performance

Extractive-industry evidence directly demonstrates the importance of structured monitoring. Mutua and Nzulwa (2023) examined monitoring and evaluation frameworks and the success of extractive-industry projects in Kenya. Their work associated stronger project performance with clear monitoring arrangements, regular assessment and the use of implementation information for management decisions. This evidence supports the view that mining projects require continuous tracking of production, costs, safety, resource use and milestones rather than relying on end-of-project assessment alone.

Regional evidence from Tanzania provides a wider performance-monitoring perspective. Countdown 2030 Collaboration (2023) examined performance monitoring of national strategic plans using Tanzania as a case. The study illustrates the value of systematic indicators and recurring review for determining whether planned interventions are producing intended results. This evidence supports results-based monitoring in mining projects because managers need timely comparisons between targets and actual performance to identify deviations, assign corrective actions and preserve accountability.

Rwandan implementation evidence was also provided by the Ministry of Finance and Economic Planning (2023) through its annual report on project implementation and sustainability of national development initiatives. The report reflects the importance of monitoring implementation progress and sustainability across public investments. Although the institutional setting differs from mining, the evidence supports planned monitoring arrangements that connect objectives, implementation evidence and management action. This principle is relevant to Bugarama Wolfram Mining Project where operational data must be translated into corrective decisions.

National audit evidence further demonstrates why monitoring needs to be continuous and evidence based. The Office of the Auditor General (2024) assessed the performance of state-funded development projects and documented implementation performance as an accountability concern. The report supports the use of structured progress information, timely review and responsible follow-up where public and institutional resources are committed to projects. This evidence reinforces the importance of reporting systems that make deviations visible before they become persistent cost, schedule or quality problems.

A broader public-investment perspective was provided by the World Bank Group (2023), which examined the efficiency of public investment and project delivery in Rwanda. The evidence emphasised the need for stronger implementation systems to convert investment into results. This supports monitoring and evaluation planning because project managers require reliable data, performance indicators and feedback mechanisms to determine whether resources and activities remain aligned with intended outcomes. The same logic applies to mining projects where operational performance must be reviewed continuously against production, cost, quality and timing expectations.

# 3. Methodology

This section presents the research design, study population, census approach, instruments, pilot procedures, data analysis and ethical safeguards.

## 3.1 Research Design

A research design is the overall plan or blueprint that guides the collection and analysis of data for answering research questions and testing hypotheses (Ashvin, 2022). The study adopted descriptive and correlational research designs using quantitative and qualitative approaches. The descriptive design summarised project resource planning, risk mitigation planning, stakeholders engagement planning, monitoring and evaluation planning and project performance. The correlational design determined the direction, strength and statistical significance of relationships between the planning practices and project performance, while qualitative interviews provided contextual explanations of implementation conditions.

## 3.2 Study Population

A study population refers to the total group of individuals or units possessing specific characteristics relevant to the subject being investigated (Memon et al., 2023). The study population comprised 189 individuals directly involved in planning, implementation and oversight of Bugarama Wolfram Mining Project. The population included 9 project managers and engineers, 91 site supervisors and technical staff, 28 supporting staff, 41 partners and 20 local leaders. Their direct involvement provided relevant knowledge about resource use, operational risks, stakeholder relations, monitoring systems and project performance.

## 3.3 Sampling Design

Sampling is the process through which a researcher selects participants from a study population to obtain information for drawing valid conclusions about the population (Sterman, 2022). A census approach was used because the target population of 189 respondents was manageable and all identified categories were relevant to the study. Including the full population avoided selecting only a subset of project actors and ensured representation of management, technical, support, partner and local-leadership perspectives. The approach was therefore appropriate for capturing the range of planning practices applied in Bugarama Wolfram Mining Project.

## 3.4 Data Collection Instrument

Documentation, a structured questionnaire and semi-structured interviews were used to collect data. Documentary review covered project plans, budget reports, risk registers and available implementation records. The questionnaire used five-point Likert-scale statements covering project resource planning, risk mitigation planning, stakeholders engagement planning, monitoring and evaluation planning and project performance. Interviews were conducted with 11 key informants to provide contextual explanations of project implementation and management conditions.

## 3.5 Pilot Study, Validity and Reliability

A pilot study was conducted with 19 respondents at Nyakabingo Mine in Rulindo District, representing approximately 10% of the study population. The site was separate from Bugarama Wolfram Mining Project and provided a comparable mining environment for assessing questionnaire clarity, instructions and practical administration before the main data collection.

Content validity was assessed through expert review. The questionnaire contained 20 relevant measurement statements and 4 demographic categories, producing a Content Validity Index of 0.83. The value exceeded the acceptable benchmark of 0.70 and confirmed adequate content coverage of the study variables (Zuriguel-Pérez, 2025).

Reliability was tested using pilot data and Cronbach's alpha. Coefficients were 0.841 for project resource planning, 0.830 for risk mitigation planning, 0.817 for stakeholders engagement planning, 0.828 for monitoring and evaluation planning and 0.856 for project performance. Since all coefficients exceeded 0.70, the questionnaire demonstrated acceptable internal consistency (Kalkbrenner, 2023).

## 3.6 Data Analysis

Quantitative questionnaire data were analysed using SPSS version 29. Frequencies, percentages, means and standard deviations supported descriptive analysis. Pearson correlation tested the direction and strength of the objective-specific relationships, while multiple linear regression estimated the combined and individual effects of the four planning practices on project performance at the 0.05 significance level. Qualitative interview evidence was analysed thematically to support interpretation of the quantitative findings.

The regression model was specified as $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$, where Y represented Project Performance; $X_1$ Project Resource Planning; $X_2$ Risk Mitigation Planning; $X_3$ Stakeholders Engagement Planning; $X_4$ Monitoring and Evaluation Planning; $\beta_0$ the constant; $\beta_1$–$\beta_4$ the regression coefficients; and $\varepsilon$ the error term.

## 3.7 Ethical Considerations

The study followed informed consent, voluntary participation, confidentiality, privacy, anonymity and academic-use principles. Institutional permission was obtained before data collection, respondents were informed of the study purpose and their right to withdraw, and collected information was stored securely. Individual names were not included in questionnaires or reported findings, and project information was used only for the objectives of the study.

# 4. Results and Discussions

This section presents the response rate and inferential findings obtained from participants in Bugarama Wolfram Mining Project.

## 4.1 Response Rate

This section presents questionnaire participation among respondents selected from Bugarama Wolfram Mining Project.

**Table 1: Response rate**

| Questionnaires | Frequency | Percentage (%) |
|---|---|---|
| Returned Complete | 181 | 95.8 |
| Returned Incomplete | 5 | 2.6 |
| Unreturned | 3 | 1.6 |
| Total | 189 | 100.0 |

Source: Primary Data, 2026

Table 1 shows that 181 of the 189 distributed questionnaires were returned complete, representing a response rate of 95.8%. Five questionnaires, equivalent to 2.6%, were returned incomplete, while three questionnaires, representing 1.6%, were unreturned. The 181 complete responses provided the cases used for quantitative analysis and gave strong coverage of the intended census population.

## 4.2 Inferential Statistics

This section presents correlation and regression results linking the four planning practices with project performance.

### 4.2.1 Correlation Analysis

This section presents the strength, direction and significance of relationships between planning practices and project performance.

**Table 2: Correlation between project planning practices and Project Performance**

| | | Project Resource Planning | Risk Mitigation Planning | Stakeholders Engagement Planning | Project Monitoring and Evaluation | Project Performance |
|---|---|---|---|---|---|---|
| Project Resource Planning | Pearson Correlation | 1 | .934** | .690** | .935** | .958** |
| | Sig. (2-tailed) | | .000 | .000 | .000 | .000 |
| | N | 181 | 181 | 181 | 181 | 181 |
| Risk Mitigation Planning | Pearson Correlation | .934** | 1 | .623** | .929** | .941** |
| | Sig. (2-tailed) | .000 | | .000 | .000 | .000 |
| | N | 181 | 181 | 181 | 181 | 181 |
| Stakeholders Engagement Planning | Pearson Correlation | .926** | .924** | 1 | .926** | .951** |
| | Sig. (2-tailed) | .000 | .000 | | .000 | .000 |
| | N | 181 | 181 | 181 | 181 | 181 |
| Monitoring and Evaluation Planning | Pearson Correlation | .935** | .929** | .707** | 1 | .944** |
| | Sig. (2-tailed) | .000 | .000 | .000 | | .000 |
| | N | 181 | 181 | 181 | 181 | 181 |
| Project Performance | Pearson Correlation | .958** | .941** | .794** | .944** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | |
| | N | 181 | 181 | 181 | 181 | 181 |

**. Correlation is significant at the .01 level (2-tailed).

Source: Primary Data, 2026

Table 2 shows that Project Resource Planning was strongly and positively related to Project Performance ($r = 0.958$; $p = 0.000$). Since $p < 0.05$, the relationship was statistically significant. This indicates that stronger equipment scheduling, procurement, skills planning and allocation of financial and human resources were associated with improved performance of Bugarama Wolfram Mining Project.

This relationship aligns with Afshari and Sobhanifard (2023), who connected systematic resource allocation with improved construction performance. Their evidence supports the present result because mining activities depend on timely coordination of specialised equipment, labour, materials and finance to avoid operational interruptions.

Risk Mitigation Planning was positively related to Project Performance (r = 0.941; p = 0.000). The relationship was statistically significant at the 0.05 level, showing that stronger identification, assessment, response planning and risk-register use were associated with improved project performance.

The result resonates with Aven (2024), who emphasised proactive identification and assessment of uncertainty as conditions for stable project delivery. The current evidence similarly shows that mining performance is strengthened when geological, environmental, technical and financial risks are considered before they disrupt implementation.

Stakeholders Engagement Planning had a strong positive relationship with Project Performance (r = 0.951; p = 0.000). Since $p < 0.05$, the relationship was statistically significant. This indicates that stakeholder identification, influence analysis, communication and clear responsibilities were associated with stronger project outcomes.

This association is consistent with Freeman et al. (2021), who linked project value with the effective management of stakeholder interests, participation and responsibilities. In mining projects, coordinated relationships among project teams, partners, regulators and communities can strengthen cooperation and reduce implementation conflict.

Monitoring and Evaluation Planning was positively related to Project Performance (r = 0.944; p = 0.000). The statistically significant relationship indicates that structured data collection, progress tracking, evaluation schedules and reporting were associated with stronger project performance.

The finding aligns with Mutua and Nzulwa (2023), who associated structured monitoring and evaluation frameworks with the success of extractive-industry projects. Their evidence supports regular performance information as a basis for identifying deviations and initiating corrective action during implementation.

### 4.2.2 Regression Analysis

Multiple regression assessed the combined explanatory power and individual effects of the four planning practices on Project Performance.

**Table 3: Model summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .976a | .953 | .952 | .16900 | 1.997 |

a. Predictors: (Constant), Monitoring and Evaluation Planning, Stakeholders Engagement Planning, Risk Mitigation Planning, Project Resource Planning

b. Dependent Variable: Project Performance

Source: Primary Data, 2026

The model produced R = 0.976, indicating a very strong combined relationship between the four planning practices and Project Performance. R Square was 0.953, meaning that the predictors jointly explained 95.3% of the variation in project performance, while the adjusted R Square remained 0.952. The Durbin-Watson statistic of 1.997 was close to 2.000 and supported acceptable independence of residual errors.

The combined explanatory pattern agrees with Cheserek and Sangoro (2023), who connected infrastructure-project success with the coordinated application of complementary planning practices. The result supports examining resource planning, risk mitigation, stakeholder engagement, and monitoring and evaluation as an integrated management system rather than as unrelated activities.

**Table 4: ANOVA results**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 10.573 | 4 | 3.426 | 881.000 | .000b |
| | Residual | .520 | 176 | .029 | | |
| | Total | 11.092 | 180 | | | |

a. Dependent Variable: Project Performance

b. Predictors: (Constant), Monitoring and Evaluation Planning, Stakeholders Engagement Planning, Risk Mitigation Planning, Project Resource Planning

Source: Primary Data, 2026

The ANOVA results show that the regression model was statistically significant (F = 881.000; p = 0.000). Since p was below 0.05, Project Resource Planning, Risk Mitigation Planning, Stakeholders Engagement Planning, and Monitoring and Evaluation Planning jointly provided a statistically reliable explanation of Project Performance in Bugarama Wolfram Mining Project.

This joint significance is consistent with Mukunzi and Mulyungi (2022), whose Rwandan mining evidence linked project performance with coordinated planning

across technical, financial and operational requirements. The current model similarly shows that mining performance is explained by the combined operation of several planning dimensions.

**Table 5: Regression coefficients**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| 1 | (Constant) | .107 | .061 | | 1.754 | .084 | | |
| | Project Resource Planning | .326 | .048 | .193 | 6.792 | .000 | .087 | 11.458 |
| | Risk Mitigation Planning | .118 | .045 | .213 | 2.622 | .010 | .093 | 10.727 |
| | Stakeholders Engagement Planning | .265 | .042 | .414 | 6.310 | .000 | .103 | 9.686 |
| | Monitoring and Evaluation Planning | .143 | .047 | .162 | 3.043 | .003 | .091 | 10.981 |

a. Dependent Variable: Project Performance

Source: Primary Data, 2026

Table 5 shows that the constant was positive (B = 0.107; t = 1.754; p = 0.084) but was not statistically significant at the 0.05 level. The tolerance values ranged from 0.087 to 0.103 and VIF values from 9.686 to 11.458. These diagnostics indicate notable multicollinearity among some predictors, so the isolated coefficient magnitudes were interpreted cautiously while preserving the significance tests reported in the dissertation.

Project Resource Planning had a positive and statistically significant effect on Project Performance (B = 0.326; t = 6.792; p = 0.000). A one-unit increase in project resource planning increased project performance by 0.326 units when the other predictors were held constant. The effect supports the corresponding null-hypothesis rejection.

This effect aligns with Afshari and Sobhanifard (2023), who explained that coordinated allocation of financial, human, material and technical resources reduces shortages, idle time and operational interruptions. The current coefficient similarly indicates that organised resource deployment made an independent contribution to mining project performance.

Risk Mitigation Planning had a positive and significant effect on Project Performance (B = 0.118; t = 2.622; p = 0.010). Holding the other predictors constant, a one-unit increase in risk mitigation planning increased project performance by 0.118 units. Since $p < 0.05$, the corresponding null hypothesis was rejected.

The finding is consistent with Aven (2024), who described proactive risk planning as a process for identifying uncertainty, assessing consequences and preparing responses before disruption occurs. This evidence supports formal risk registers, contingency measures and recurring review in mining environments.

Stakeholders Engagement Planning had a positive and statistically significant effect on Project Performance (B = 0.265; t = 6.310; p = 0.000). A one-unit increase in stakeholders engagement planning increased project performance by 0.265 units when the remaining predictors were controlled. The corresponding null hypothesis was therefore rejected.

The result is supported by Freeman et al. (2021), who emphasised that project value is strengthened when stakeholder interests, knowledge and responsibilities are integrated into project decisions. Planned engagement therefore contributed to cooperation, legitimacy and implementation continuity within the mining project.

Monitoring and Evaluation Planning had a positive and significant effect on Project Performance (B = 0.143; t = 3.043; p = 0.003). A one-unit increase in monitoring and evaluation planning increased project performance by 0.143 units when the other predictors remained constant. The corresponding null hypothesis was rejected.

The result aligns with Mutua and Nzulwa (2023), who linked structured monitoring frameworks with improved performance in extractive-industry projects. Clear indicators, progress reviews and reporting systems provide evidence for correcting deviations before they weaken production, cost, quality or schedule outcomes.

The fitted model was: Project Performance = 0.107 + 0.326(Project Resource Planning) + 0.118(Risk Mitigation Planning) + 0.265(Stakeholders Engagement Planning) + 0.143(Monitoring and Evaluation Planning) + ε.

## 4.3 Decision on Null Hypotheses

This section presents the statistical decisions reached for the four null hypotheses using the 0.05 significance level.

**Table 6: Decision on null hypotheses**

| Hypothesis | Null Hypothesis | Sig. | Decision |
|---|---|---|---|
| H01 | Project resource planning has no significant effect on performance of Bugarama Wolfram Mining Project. | .000 | Rejected |
| H02 | Stakeholders engagement planning has no significant effect on performance of Bugarama Wolfram Mining Project. | .000 | Rejected |
| H03 | Project risk planning has no significant effect on performance of Bugarama Wolfram Mining Project. | .010 | Rejected |
| H04 | Monitoring and evaluation planning has no significant effect on performance of Bugarama Wolfram Mining Project. | .003 | Rejected |

Source: Primary Data, 2026

Table 6 shows that all four predictor significance values were below 0.05. H01, H02, H03 and H04 were therefore rejected, confirming statistically significant effects of project resource planning, stakeholders engagement planning, risk mitigation planning, and monitoring and evaluation planning on Project Performance.

# 5. Conclusions and Recommendations

This section presents conclusions drawn from the findings and practical recommendations for improving mining project performance.

## 5.1 Conclusion

The study concluded that Project Resource Planning and Risk Mitigation Planning strengthened the performance of Bugarama Wolfram Mining Project. Coordinated equipment schedules, procurement arrangements, skills planning and resource allocation supported continuity of mining activities, while systematic identification and management of operational, geological, environmental and financial risks helped protect implementation from avoidable disruption.

Stakeholders Engagement Planning and Monitoring and Evaluation Planning also strengthened Project Performance. Clear stakeholder identification, communication and responsibility arrangements supported cooperation and legitimacy, while structured monitoring, progress tracking, evaluation and reporting supplied evidence for timely corrective action. Overall, the findings show that mining project performance is supported by the integrated application of resource planning, risk control, stakeholder engagement and continuous performance monitoring.

## 5.2 Recommendations

This section presents recommendations derived from the study findings and conclusions. Suggestions for future research are also provided.

1. Bugarama Wolfram Mining Project management should maintain an integrated resource schedule linking machinery, maintenance, materials, skilled personnel and financial allocations with planned extraction activities.
2. Project management should maintain an active risk register covering geological, environmental, safety, equipment, supply and market risks, with assigned responsibilities, response measures and regular review dates.
3. The project should maintain structured stakeholder forums connecting project teams, workers, partners, local authorities, regulators and surrounding communities, with documented responsibilities and follow-up actions.
4. Monitoring and evaluation teams should use standardised indicators and reporting tools for production, resource use, cost, quality, safety and schedule performance and convert identified gaps into corrective actions.
5. Future research should compare mining projects across districts and examine digital resource scheduling, geological-risk management, community engagement and real-time monitoring as additional determinants of mining project performance.

# References

Afshari, H., & Sobhanifard, Y. (2023). Modeling the impact of resource allocation on construction performance. *Journal of Infrastructure Systems, 29*(4), 04023021.

Agyekum, K., Simons, B., & Botchway, S. Y. (2022). Factors influencing the performance of gold mining projects: A case study of the Tarkwa mining region in Ghana. *Journal of African Business, 23*(4), 512–530.

Akpan, E. O., & Chizea, F. J. (2023). Integrated project planning and the critical path method in modern construction. *International Journal of Project Management, 41*(3), 102432.

Ali, M. A., Ogolla, K., & Nzioki, S. C. (2022). Project management practices and performance of housing projects in Kenya. *International Journal of Social Sciences and Management Review, 5*(2), 154–168.

Ashvin Rural Ayurved College and Hospital. (2022, November 21). *Basic research methodology workshop activity report*. https://www.arac.co.in/basic-research-methodology-workshop-activity-report/

Aven, T. (2024). A holistic framework for risk management in project success. *Journal of Risk Research, 27*(1), 45–62.

Barney, J. B., & Hesterly, W. S. (2011). *Strategic management and competitive advantage: Concepts*. Pearson.

Bourne, L. (2024). *Stakeholder relationship management: A framework for project success*. Routledge.

Cheserek, G., & Sangoro, O. (2023). The effect of planning practices on the success of infrastructure projects in East Africa. *East African Journal of Engineering, 6*(2), 201–215.

Countdown 2030 Collaboration. (2023). Performance monitoring of national strategic plans: A case of Tanzania. *The Lancet Global Health, 11*(5), e741–e752.

Dufitumukiza, J. (2022). Project planning and sustainability of agricultural market infrastructure in Rwanda. *Global Scientific Journal, 10*(6), 112–125.

El Amri, A., & Belhadi, A. (2022). Digital transformation and value chain performance in the Moroccan phosphate industry: The role of integrated project planning. *International Journal of Production Economics, 245*, 108–124.

Eric, N. (2021). The effect of planning on infrastructure project outcomes in Rwandan local government. *Journal of Management and Commerce Innovations, 9*(1), 342–356.

Freeman, R. E., Dmytriyev, S. D., & Phillips, R. A. (2021). Stakeholder theory and the world of project management. *Project Management Journal, 52*(3), 213–220.

Grant, R. M. (1991). The resource-based theory of competitive advantage: Implications for strategy formulation. *California Management Review, 33*(3), 114–135.

Habimana, O., & Nkikabahizi, F. (2023). Impact of operational disruptions on the export performance of the Rwandan mining sector. *Rwanda Economic Journal, 12*(2), 88–105.

Igharo, K., & Osazevbaru, H. O. (2024). Project planning and performance of capital-intensive projects: A global perspective on mineral extraction. *Global Journal of Management and Business Research, 24*(1), 15–29.

Kalkbrenner, M. T. (2023). Choosing between Cronbach's coefficient alpha and McDonald's omega for reliability. *Measurement and Evaluation in Counseling and Development, 56*(1), 1–15.

Lopes, J., & Banaitienė, N. (2024). The role of the construction industry in national economy: A North African perspective. *Sustainability, 16*(2), 753.

Matějka, K. (2021). The project budget as a management planning and control tool. *European Management Journal, 39*(4), 512–526.

Mayer, Z., Hill, R., & Thompson, P. (2022). Digital twin technologies and front-end planning in the United States critical minerals market. *Resources Policy, 78*, 102–116.

McQuilken, J., Nkundibiza, A. P., Munir, L., & Niyonsaba, I. (2023). Illuminating small-scale mining in Rwanda. In *2023 state of the artisanal and small-scale mining sector*. World Bank.

Memon, A. H., Memon, I., Khahro, S. H., & Javed, Y. (2023). Resource planning and its impact on infrastructure performance in Asian cities. *Engineering, Construction and Architectural Management, 30*(2), 445–462.

Ministry of Finance and Economic Planning. (2023). *Annual report on project implementation and sustainability of national development initiatives (2022–2023)*. Government of Rwanda.

Ministry of Trade and Industry. (2024). *Private Sector Development and Youth Employment sector backward-looking joint sector review report for financial year 2023/2024*. Government of Rwanda.

Mrosso, R. J., & Mwakujonga, J. (2024). Legislative reforms and the performance of gold mining projects in the Lake Victoria Goldfield, Tanzania. *Tanzanian Journal of Development Studies, 21*(1), 67–84.

Mukunzi, J., & Mulyungi, P. (2022). Influence of project planning practices on the performance of mining projects in Rwanda: A case of Wolfram Mining and Processing Ltd. *The International Journal of Business Management and Technology, 6*(3), 142–156.

Mutua, J. M., & Nzulwa, J. (2023). Monitoring and evaluation frameworks and the success of extractive industry projects in Kenya. *The Strategic Journal of Business & Change Management, 10*(2), 314–328.

Office of the Auditor General. (2023). *Report of the Auditor General on the management of stalled and abandoned public projects in Rwanda*. Office of the Auditor General.

Office of the Auditor General. (2024). *Annual report on the performance of state-funded development projects for the fiscal year ended June 2023*. Office of the Auditor General.

Oluwafunmilola, A. (2022). Global phenomenon of delays in construction: The role of risk management. *Construction Innovation, 22*(3), 334–352.

Perrier, N. (2021). Iterative planning approaches in the construction industry. *Journal of Management in Engineering, 37*(2), 04020101.

Pratama, A., Santoso, B., & Wijaya, H. (2024). Logistical planning and the delivery performance of nickel smelter projects in Sulawesi, Indonesia. *Journal of Asian Economics, 91*, 101–118.

Rwanda Mines, Petroleum and Gas Board. (2023). *Mining sector performance review and professionalization roadmap (2024–2028)*. Rwanda Mines, Petroleum and Gas Board.

Rwanda Mines, Petroleum and Gas Board. (2025a). *Annual report on mineral extraction efficiency and technological adoption in Rwandan mining sites*. Rwanda Mines, Petroleum and Gas Board.

Rwanda Mines, Petroleum and Gas Board. (2025b). *How Rwanda's mining sector is powering towards the NST-2 USD 2.17 billion goal*. https://www.rmb.gov.rw/updates/news-detail/how-rwandas-mining-sector-is-powering-towards-the-nst-2-usd-217-billion-goal

Sjøveian, A., & Lindstøl, T. (2023). Arctic mining performance: Balancing environmental planning and operational efficiency in Northern Norway. *Scandinavian Journal of Management, 39*(2), 154–170.

Smith, R. (2022). Co-design and teacher involvement in London primary schools. *British Journal of Educational Studies, 70*(4), 450–468.

Stacey, R. D. (2001). *Complex responsive processes in organizations: Learning and knowledge creation*. Routledge.

Sterman. (2022). [Full bibliographic details were not provided in the source dissertation].

Uwera, G., & Dushimimana, J. D. (2025). Effect of project planning on project performance: A case of PRISM project in Rulindo District, Rwanda. *African Journal of Empirical Research, 6*(1), 736–750.

World Bank Group. (2023). *Rwanda economic update: Enhancing the efficiency of public investment and project delivery*. World Bank.

Zhang, L., & Li, X. (2023). Intelligence-driven planning and the performance of "Green Mines" in China's coal sector. *Energy Policy, 175*, 113–128.

Zhang, Y. (2023). Digital transformation and sustainable supply chain performance in construction. *Engineering, Construction and Architectural Management, 30*(5), 1892–1910.

Zuriguel-Pérez, E. (2025). Preliminary assessment of content validity and internal consistency of project management instruments. *Medical and Pharmaceutical Research, 19*(3), 505–5

15.