



Full length article

Influence of Project Management Tools on the Performance of selected Mining Projects in Rwanda: A case of Rutongo Mining Project

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ABSTRACT

Background: The study aimed to investigate the impact of information communication and technology (ICT) tools on mining project performance in Rwanda, focusing on the Rutongo Mining Project. Specific objectives included examining the influence of cost control, time tracking, quality assurance, and electronic communication tools. Drawing from theories like Information Systems Theory and the Resource-Based View, a descriptive survey combined qualitative and quantitative methods. **Aim:** The study aimed to investigate the influence of project management tools on the performance of mining projects in Rwanda. **Materials and Methods:** The target population comprised 136 mining professionals, with a sample size of 102 determined by Slovin's formula and selected through purposive and random sampling. Primary data was collected via a questionnaire, while secondary data encompassed various sources such as project reports and academic literature. Triangulation ensured validity, and reliability was upheld via Cronbach's alpha coefficient. Thematic analysis was used for qualitative data, while descriptive statistics analyzed quantitative data. **Results:** Quality assurance tools had the strongest positive impact ($\beta = 0.883$, $p < 0.001$) on project performance, while cost control tools had a negative impact ($\beta = -0.196$, $p = 0.005$), and time tracking tools showed no significant relationship ($\beta = 0.020$, $p = 0.752$). **Discussion:** These findings underscore the importance of striking a balance between quality assurance and cost management in mining project implementation. The results of the data analysis provided important new information about how various ICT tools affect the performance of mining projects. **Conclusion:** The study highlights the crucial role of ICT tools in enhancing mining project performance in Rwanda. By prioritizing quality assurance measures while maintaining a balanced approach to cost control, stakeholders can optimize the outcomes of projects like the Rutongo Mining Project. These recommendations offer actionable insights for policymakers, project managers, and stakeholders, contributing to the sustainable growth of Rwanda's mining industry.

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1. Introduction

The project management method has a significant impact on the success of project performance in the mining industry globally employed across all stages of the project lifecycle, including planning, implementation, and commissioning[1]. From exploration to extraction and processing, mining projects are complex endeavors that require meticulous planning, efficient execution, and seamless coordination among various stakeholders[2]. ICT tools have increasingly permeated mining operations, offering opportunities to enhance efficiency, safety, and sustainability[3]. According to World Bank data [4], the mining sector contributes significantly to GDP in many countries, providing essential raw materials for various industries.

In 2012, Jafari et al. emphasized the importance of integrating ICT to improve efficiency and safety in mining operations in the United States. Smith and Jeong followed them in 2016, who studied the use of geospatial technologies like Geographic Information Systems (GIS) to enhance resource extraction and mine planning. Wang et al. highlighted the role of automation and robotics in boosting productivity and cutting labor costs in the mining sector. Moving to Europe, it has played a crucial role in shaping global culture, economics, and politics. According to Jones (2018), Europe's rich history has had a deep impact on contemporary society. From fueling innovation during the Renaissance to driving progress in various fields such as science, technology, and governance during the Industrial Revolution, Europe has been a center of transformative change[5]. Moreover, European countries like Sweden have been pioneers in adopting advanced technologies in mining operations, demonstrating the potential benefits of using ICT tools to optimize resource extraction and reduce the ecological footprint (Bengtsson et al., 2018). While Europe faces modern challenges like Brexit, immigration, and climate change, understanding its historical context is crucial for navigating the complexities of the region's present and future[6].

As highlighted by Hilson and Yakovleva (2017), the mining industry in Sub-Saharan Africa has historically been a significant contributor to the region's Gross Domestic Product (GDP) and export revenues. However, it has also posed environmental, social, and governance challenges. The integration of Information Communication and Technology (ICT) tools in mining operations in this region presents both opportunities and challenges. Researchers such as Ncube et al acknowledge the potential benefits of ICT adoption in the mining sector, including enhanced productivity, safety, and decision-making processes. Nevertheless, the effective implementation of ICT tools in Sub-Saharan African mining contexts requires a nuanced understanding of contextual factors such as infrastructural limitations, regulatory frameworks, and workforce capacity[7].

Algeria's energy sector has historically been a cornerstone of its economy, significantly contributing to both domestic revenues and international energy markets[8]. However, Algeria has recognized the importance of diversifying its economy and reducing dependency on hydrocarbon exports, leading to a growing emphasis on sectors such as mining and renewable energy[4]. This shift aligns with Algeria's broader development goals outlined in the National Development Plan and the Vision 2030 strategy, which emphasize sustainable development and economic diversification[9]. As Algeria seeks to use its abundant mineral resources, including iron ore, phosphate, and gold, to drive economic growth and employment opportunities[10], understanding the factors influencing the performance of mining projects becomes increasingly crucial.

The East African nation of Uganda is rich in natural resources, including minerals such as iron ore, copper, and gold[11]. Over the past few years, Uganda's mining industry has expanded significantly, boosting the country's

foreign exchange earnings and economic growth[12]. However, despite its potential, the mining industry in Uganda faces several challenges, including operational inefficiencies, safety concerns, and environmental degradation[13].

Information and Communication Technology (ICT) tools have emerged as potential solutions to address these challenges and enhance the performance of mining projects in Uganda. By leveraging ICT tools such as data analytics, remote monitoring, and automation, mining companies can improve operational efficiency, ensure worker safety, and minimize environmental impact[14]. Rwanda's economy heavily relies on mining, which creates job opportunities and generates export revenue[15]. However, the sector encounters various difficulties, including operational inefficiencies, safety issues, and adverse environmental effects[16]. In recent years, the use of Information and Communication Technology (ICT) has become increasingly popular as a means to enhance the global performance of mining operations[17].

The Rutongo Mining Project in Rwanda represents a significant initiative in the country's mining sector, which has undergone notable development in recent years. Rwanda's mining sector has grown and diversified, contributing to the country's economic development and poverty reduction efforts ([18]. However, despite progress, challenges persist, particularly in optimizing the performance of mining projects.

1.1 Statement of the Problem

The Rutongo Mining Project in Rwanda faces challenges due to a lack of comprehensive studies on mining projects in the country. There is a need for research on how ICT tools can enhance the efficiency, safety, and sustainability of mining operations in Rwanda, especially at the Rutongo Mining Project. Integrative research on cost control, time tracking, quality assurance, and electronic communication tools in the Rwandan mining sector is lacking. Further research is needed to understand how these tools interact and influence project performance. It is essential to identify the potential of ICT tools in improving mining project performance and to explore the specific challenges and opportunities associated with their adoption.

1.2 Research purpose

The study aimed to investigate the influence of project management tools on the performance of mining projects in Rwanda.

2. Materials and Methods

2.1 Research Design

The study employed a descriptive survey research methodology that integrated qualitative and quantitative approaches to thoroughly examine the impact of ICT tools on mining project performance. Mixed methods research, as defined by Creswell and Plano Clark, entails gathering, evaluating, and combining qualitative and quantitative data in a single study to enable a more thorough grasp of the research subject. This study explored the perceptions, experiences, and underlying mechanisms associated to the use of ICT technologies in mining projects using qualitative approaches such literature reviews, interviews, and case studies.

Semi-structured interviews were conducted with key stakeholders, comprising miners, engineers, managers, and environmental specialists, to get qualitative data about their experiences using ICT tools for mining project

management. To provide a theoretical framework, a comprehensive evaluation of the body of research on ICT applications in the mining sector was also carried out[19] .

In parallel, the relationship between the employment of ICT tools and several mining project performance metrics was analyzed using quantitative methodologies. In order to test hypotheses and provide answers to research questions, quantitative research, according to Hair et al. (2019), entails gathering and evaluating numerical data. Surveys were given to a sample of mining project stakeholders, including miners, engineers, managers, and technicians, in order to gather quantitative data for this study[20].

2.2 Target Population

According to Shukla (2020), the study results were applied to a specified set of specifications, which is known as the target population. The target population for this study comprised of 136 individuals involved in Rutongo Mines. This includes project managers, engineers, geologists, technicians, government regulators, and representatives from Rutongo mines. The study aims to gather insights and perspectives from individuals with firsthand experience and expertise in managing and executing mining projects in Rutongo Mines. The distribution of the projects is shown in Table 1

Table 1: Target Population

Category	Population
Miners	32
Engineers	14
Managers	11
Technicians	18
Environmental Specialists	7
Safety Inspectors	23
Geologists	9
Administrative Staff	17
Other Stakeholders	5
Total	136

Source: Human Resource Rutongo Mines (2024)

2.3 Data Collection Techniques and Data Sources

Data collection techniques in the study included the use of a questionnaire to gather primary data and the application of thematic analysis for qualitative data, while descriptive statistics were employed to analyze quantitative data. Data sources comprised primary data collected directly from the respondents and secondary data obtained from various sources such as project reports, scholarly writing, and official government publications.

2.4 Ethical Consideration

The study adhered to ethical guidelines and regulations established by both Rutongo Mines and Mount Kenya University. This includes obtaining ethical approval from the relevant institutional review boards or ethics committees before commencing the research activities. Researchers must conduct the study with integrity, honesty, and transparency, ensuring that the research findings are accurately reported and interpreted. Fur-

thermore, researchers must be mindful of the potential impact of their study on the local community and environment surrounding Rutongo Mines. They should strive to minimize any potential harm or disruption caused by the research activities and actively engage with local stakeholders to promote mutual understanding and collaboration. By upholding these ethical principles, researchers can ensure that their study contributes to the advancement of knowledge while respecting the rights and welfare of all individuals and entities involved in the mining projects at Rutongo Mines.

3. Results

3.1 Cost Control Tools and Mining Project Performance

The findings presented in Table 2 provide valuable insights into the impact of cost control tools on the performance of mining projects in Rwanda. The table indicates that the majority of respondents strongly agree (SA) or agree (A) that the utilization of cost control tools has significantly improved project budget adherence, helped in identifying and mitigating project cost overruns, contributed to overall project efficiency, enabled better decision-making regarding resource allocation and expenditure prioritization, positively influenced profitability and financial sustainability, and significantly contributed to improving time tracking tools in mining projects.

Table 2: Descriptive for Cost Control Tools

Statements on Cost Control Tools	SD	D	N	A	SA	Mean	Std Dev.
The utilization of cost control tools in our mining projects has significantly improved project budget adherence.	0.0 %	0.0 %	0.0%	53.2%	46.8 %	4.47	.502
Cost control tools have effectively helped in identifying and mitigating project cost overruns in our mining operations.	0.0 %	0.0 %	0.0%	47.9%	52.1 %	4.52	.502
The implementation of cost control measures has contributed to the overall efficiency of our mining projects in Rwanda.	0.0 %	0.0 %	0.0%	51.1%	48.9 %	4.49	.503
Cost control tools have enabled better decision-making regarding resource allocation and expenditure prioritization within our mining project	0.0 %	0.0 %	0.0%	33.0%	67.0 %	4.67	.473
The use of cost control tools has positively influenced the profitability and financial sustainability of our mining projects in Rwanda.	0.0 %	0.0 %	0.0%	47.9%	52.1 %	4.52	.502
Cost control tools, such as budget-	0.0	0.0	0.0%	42.6%	57.4	4.57	.497

ing software and expense tracking systems, significantly contribute to improving Time Tracking Tools in mining projects.

Source: **Researcher data, (2024).**

Table 2 presents the descriptive statistics for statements related to cost control tools' utilization and impact on mining projects in Rwanda. The findings indicate a high level of agreement ($M = 4.47$ to 4.67 , $SD = .473$ to $.503$) among respondents regarding the effectiveness of these tools in improving various aspects of project management. Specifically, the majority of respondents strongly agreed (SA) or agreed (A) that cost control tools have significantly improved project budget adherence (46.8% SA, 53.2% A), helped identify and mitigate cost overruns (52.1% SA, 47.9% A), contributed to overall project efficiency (48.9% SA, 51.1% A), enabled better decision-making regarding resource allocation (67.0% SA, 33.0% A), and positively influenced profitability (52.1% SA, 47.9% A). These findings align with existing literature, which highlights the significant positive impact of cost control tools on project budget adherence, identification of cost overruns, overall efficiency, decision-making processes, financial sustainability, and integration with time tracking tools.

3.2 Time Tracking Tools and Mining Project Performance

Table 3 presents descriptive statistics for the perception of time tracking tools in managing mining project schedules. The findings indicate that a substantial majority of respondents strongly agree (SA) or agree (A) with the statements regarding the importance and effectiveness of these tools, with percentages ranging from 47.9% to 56.4%. The mean ratings for each statement are consistently high, ranging from 4.44 to 4.52 on a scale of 1 to 5, suggesting a strong consensus among participants regarding the utility of time tracking tools in enhancing project efficiency and addressing delays.

Table 3: Descriptive for Time Tracking Tools

Statements	SD	D	N	A	SA	Mean	Std Dev.
Time tracking tools are essential for effectively managing mining project schedules.	0.0%	0.0%	0.0%	51.1%	48.9%	4.49	.503
Accurate time tracking contributes significantly to the overall efficiency of mining project operations.	0.0%	0.0%	0.0%	56.4%	43.6%	4.44	.499
Time tracking tools are crucial for identifying and addressing potential delays in mining project timelines.	0.0%	0.0%	0.0%	47.9%	52.1%	4.52	.502
The data collected through time tracking tools is reliable and accurate for making informed deci-	0.0%	0.0%	0.0%	50.0%	50.0%	4.50	.503

sions in mining projects.

The use of time tracking tools improves the accuracy of forecasting and project planning processes in mining projects.	0.0%	0.0%	0.0%	53.2%	46.8%	4.47	.502
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Source: **Researcher data, (2024).**

Table 3 presents descriptive statistics for time tracking tools in the context of managing mining project schedules. With a mean score of 4.49 and a low standard deviation of .503, the table shows that a sizable portion of respondents considered these instruments vital (SA: 48.9%, A: 51.1%) for efficient project schedule management, indicating a high degree of agreement among respondents. With a mean score of 4.44 and a little smaller standard deviation of .499, respondents also highly rated the significance of precise time monitoring to overall project efficiency (SA: 43.6%, A: 56.4%). With a mean score of 4.52 and a standard deviation of .502, the majority also believed that time monitoring tools were essential for spotting and resolving possible delays in project schedules (SA: 52.1%, A: 47.9%). Furthermore, respondents thought that the information gathered using these instruments was accurate and dependable for making decisions (SA: 50.0%, A: 50.0%), which produced a mean score of 4.50 and a standard deviation of .503. Additionally, it was observed that the application of time monitoring tools improved the forecasting and project planning processes' accuracy (SA: 46.8%, A: 53.2%), with a mean score of 4.47 and a standard deviation of .502. In summary, the results highlight the crucial function of time monitoring instruments in mining endeavors, conforming to the extant body of literature that underscores the significance of these instruments in augmenting project scheduling, efficacy, and decision-making[21] [22]. These results highlight the consensus among respondents regarding the positive impact of time tracking tools on project management in the mining sector, thereby reinforcing the literature's assertions regarding the significance of ICT tools in optimizing project performance and outcomes.

3.3 Quality Assurance Tools and Mining Project Performance

Table 4. illustrate perceptions of respondents regarding the effectiveness and impact of quality assurance (QA) tools in mining projects in Rwanda. Across all statements, there were no respondents who strongly disagreed (SD) or disagreed (D) with the utilization and benefits of QA tools, indicating unanimous agreement or neutrality. However, the distribution of responses varied slightly among the remaining categories.

Table 4: Descriptive for Quality Assurance Tools

Statements on Quality Assurance Tools	SD	D	N	A	SA	Mean	Std Dev.
Quality assurance tools are effectively utilized in our mining projects in Rwanda.	0.0%	0.0%	0.0%	39.4%	60.6%	4.61	.491
Quality assurance tools have improved the overall efficiency of our mining operations in Rwanda	0.0%	0.0%	0.0%	42.6%	57.4%	4.57	.497
The implementation of quality assurance tools has led to a reduction in errors and defects in our	0.0%	0.0%	0.0%	38.3%	61.7%	4.62	.489

mining projects								
Quality assurance tools have enhanced the safety standards and practices within our mining projects in Rwanda	0.0%	0.0%	0.0%	40.4%	59.6%	4.60	.493	
The use of quality assurance tools has contributed to better compliance with regulatory requirements in our mining projects.	0.0%	0.0%	0.0%	46.8%	53.2%	4.53	.502	

Source: **Researcher data, (2024).**

The majority of respondents expressed agreement (A) or strong agreement (SA) with the effectiveness of QA tools, with percentages ranging from 38.3% to 46.8%. This suggests a generally positive perception of the role of QA tools in improving efficiency, reducing errors and defects, enhancing safety standards, and ensuring compliance with regulatory requirements within mining operations in Rwanda. The mean scores for each statement are notably high, ranging from 4.53 to 4.62 on a scale of 1 to 5, indicating a strong overall endorsement of the positive impact of QA tools. The low standard deviations (.489 to .502) further indicate a high level of consensus among respondents. These findings align with previous literature emphasizing the importance of QA tools in enhancing operational efficiency, safety, and compliance within the mining industry[21] . The high level of agreement underscores the significance of QA tools as essential components of modern mining practices, particularly in the context of Rwanda's mining projects.

3.4 Mining Project Performance

The table presents descriptive statistics regarding various aspects of mining project performance in Rwanda. Overall, the findings indicate high levels of satisfaction and positive perceptions across different dimensions. For instance, the mean scores for efficiency/productivity, safety enforcement, worker protection, environmental monitoring/compliance, engagement with local communities, and resource allocation all exceed 4.5 out of 5, reflecting strong agreement with these statements.

Table 5: Descriptive for Mining Project Performance

Statements on Mining Project Performance	SD	D	N	A	SA	Mean	Std Dev.
The mining projects in Rwanda demonstrate high levels of efficiency and productivity.	0.0%	0.0%	0.0%	35.1%	64.9%	4.65	.480
Safety measures within the mining projects in Rwanda are diligently enforced and adhered to.	0.0%	0.0%	0.0%	41.5%	58.5%	4.59	.495
Workers in mining projects feel adequately protected from occupational hazards and risks.	0.0%	0.0%	0.0%	47.9%	52.1%	4.52	.502
Mining projects in Rwanda	0.0%	0.0%	0.0%	46.8%	53.2%	4.53	.502

demonstrate a strong commitment to environmental monitoring and compliance.							
Environmental regulations and standards are effectively upheld within the mining projects in Rwanda.	0.0%	0.0%	0.0%	44.7%	55.3%	4.55	.500
Mining projects in Rwanda actively engage with local communities and stakeholders to address concerns and foster positive relations.	0.0%	0.0%	0.0%	41.5%	58.5%	4.59	.495
Resources were allocated efficiently throughout the project.	0.0%	0.0%	0.0%	43.6%	56.4%	4.56	.499

Source: **Researcher data, (2024).**

Table 5 reveal several key insights regarding the performance of mining projects in Rwanda. Firstly, it is notable that a significant proportion of respondents perceive high levels of efficiency and productivity within these projects, with 64.9% indicating a strong agreement (SA) and 35.1% showing agreement (A). This suggests that the mining sector in Rwanda is operating efficiently, which aligns with the literature indicating the importance of efficiency for sustainable mining practices[23]. Moreover, the data also indicate a strong commitment to safety measures, with 58.5% strongly agreeing and 41.5% agreeing that safety measures are diligently enforced and adhered to within these projects. This emphasis on safety aligns with global trends emphasizing the importance of safety protocols in mining operations[24]. Additionally, the mean scores for environmental monitoring, compliance, and community engagement are all above 4.5, indicating a high level of commitment to environmental sustainability and stakeholder engagement, which is crucial for responsible mining practices in line with global standards[25].

4. Discussion

4.1 Cost Control Tools and Mining Project Performance

The findings from the survey on the utilization and impact of cost control tools in mining projects in Rwanda reveal several noteworthy insights. Firstly, the majority of respondents strongly agree (SA) or agree (A) that the implementation of cost control tools has significantly improved project budget adherence (mean = 4.47, SD = 0.502), indicating that these tools effectively assist in managing project finances within the allocated budget. This is in line with existing literature emphasizing the importance of cost control mechanisms in maintaining financial discipline and ensuring project viability[26]. However, it is notable that despite the positive perception of budget adherence, there is no unanimous agreement among respondents, suggesting potential variations in the effectiveness of cost control tools across different mining projects.

Secondly, respondents also indicate that cost control tools have been instrumental in identifying and mitigating project cost overruns (mean = 4.52, SD = 0.502) and have contributed to the overall efficiency of mining projects in Rwanda (mean = 4.49, SD = 0.503). This is in line with the literature highlighting the role of cost control measures in minimizing financial risks and optimizing project performance[27]. Effective cost control not only helps in detecting deviations from the planned budget but also enables timely corrective actions, thereby

enhancing project efficiency and productivity. However, it's essential to acknowledge that while cost control tools may facilitate cost containment, their impact on overall project success might be influenced by various contextual factors such as project complexity, stakeholder dynamics, and market conditions[28].

Lastly, respondents perceive that cost control tools enable better decision-making regarding resource allocation and expenditure prioritization within mining projects (mean = 4.67, SD = 0.473) and positively influence project profitability and financial sustainability (mean = 4.52, SD = 0.502). This finding underscores the strategic importance of cost control tools in enhancing financial management practices and supporting long-term project viability. However, it is crucial for mining companies to continually evaluate and refine their cost control strategies to adapt to evolving project requirements and market dynamics[27].

4.2 Time Tracking Tools and Mining Project Performance

The majority of respondents (51.1% strongly agree, 48.9% agree) perceive these tools as essential, emphasizing their critical role in maintaining project timelines. This is in line with existing literature which underscores the significance of accurate time tracking for optimizing project efficiency [29]. Accurate time tracking is crucial for identifying potential delays in project schedules, enabling timely intervention to mitigate risks and ensure adherence to deadlines [30]. The high mean score (4.49) further supports the notion that time tracking tools are widely recognized as indispensable for successful project management, reflecting a strong consensus among respondents.

Moreover, the data suggests that the reliability and accuracy of information collected through time tracking tools are perceived positively by respondents, with 50.0% indicating agreement and another 50.0% expressing strong agreement. This indicates a high level of trust in the data generated by these tools, which is crucial for making informed decisions in mining projects[21]. Reliable data enables project managers to assess progress accurately, identify bottlenecks, and allocate resources effectively, ultimately enhancing project. The strong agreement among respondents underscores the perceived value of time tracking tools in providing actionable insights for project planning and execution.

Additionally, the findings suggest that the use of time tracking tools improves the accuracy of forecasting and project planning processes, with 53.2% of respondents agreeing and 46.8% strongly agreeing. This highlights the potential of these tools to enhance project predictability and reduce uncertainty, thereby increasing overall project success rates. By providing real-time data on project progress and resource utilization, time tracking tools enable more informed decision-making, allowing project managers to anticipate potential challenges and proactively address them[21].

4.3 Quality Assurance Tools and Mining Project Performance

The high percentage of respondents agreeing with statements such as "Quality assurance tools are effectively utilized in our mining projects in Rwanda" (SA: 60.6%, A: 39.4%, Mean = 4.61) and "Quality assurance tools have improved the overall efficiency of our mining operations in Rwanda" (SA: 57.4%, A: 42.6%, Mean = 4.57) underscores the recognition of these tools' significance. This aligns with research highlighting the role of quality management in enhancing project performance and customer satisfaction[27]. Effective utilization of quality

assurance tools ensures adherence to industry standards, reduces errors, and enhances overall project efficiency and effectiveness.

Furthermore, the survey results indicate that the implementation of quality assurance tools has led to tangible improvements in project outcomes, particularly in terms of error reduction and safety enhancement. With a majority of respondents agreeing that quality assurance tools have led to a reduction in errors and defects in mining projects (SA: 61.7%, A: 38.3%, Mean = 4.62) and have enhanced safety standards and practices (SA: 59.6%, A: 40.4%, Mean = 4.60), it suggests a positive correlation between quality management practices. This is in line with literature emphasizing the role of quality assurance in risk mitigation and safety improvement in mining operations (Choi *et al.*, 2019). By implementing robust quality assurance protocols, mining projects can minimize costly errors, prevent accidents, and ensure compliance with regulatory requirements, thereby enhancing overall project performance and sustainability.

However, while the survey results highlight the positive perceptions of quality assurance tools among respondents, it is essential to acknowledge potential challenges and limitations associated with their implementation. Further research could explore factors such as resource constraints, organizational culture, and stakeholder engagement, which may impact the effectiveness of quality management practices in mining projects. Addressing these challenges is crucial to maximizing the potential benefits of quality assurance tools and ensuring their successful integration into mining project management processes.

5. Limitations and Delimitations

5.1 Limitations

One limitation of the study is the potential for external factors beyond the scope of ICT to influence the performance of the Rutongo Mining Project, such as changes in government policies, global economic fluctuations, or environmental factors. Additionally, while the study covers a five-year period, there may be constraints in data availability or quality, which could impact the depth of analysis or interpretation of results. Finally, the study's reliance on retrospective data and historical information may not fully capture emerging ICT trends or advancements that have occurred after the study period, potentially limiting the relevance of findings to current mining practices.

5.2 Delimitations

The study's delimitations include focusing solely on Rutongo Mining Project in Rwanda, without delving into broader aspects of mining industry dynamics or examining other factors that may affect project performance. Additionally, the study did not explore specific technical details of ICT tools implementation, but rather concentrate on their overall impact on project efficiency and outcomes. Furthermore, the research did not extend to assessing the socio-economic or environmental implications of the Rutongo Mining Project, as these aspects fall outside the scope of the study's objectives.

6. Conclusion

6.1 Cost Control Tools and Mining Project Performance

The regression analysis suggests that overemphasizing cost control tools may harm project performance, affecting factors such as quality assurance and time tracking. While they can save costs in the short term, focusing too much on cost control can compromise long-term project outcomes. Therefore, mining projects in

Rwanda should integrate cost control tools within a comprehensive project management framework that prioritizes efficiency, quality, and safety. Further research and practical interventions are necessary to optimize the integration of cost control tools with other project management practices while aligning with project objectives and stakeholders' expectations.

6.2 Time Tracking Tools and Mining Project Performance

Respondents recognized the importance of time tracking tools in managing project schedules, identifying delays, and improving planning processes. These tools provide real-time insights, enabling project managers to make informed decisions, allocate resources efficiently, and mitigate risks, ultimately enhancing project outcomes. Effective utilization of time tracking tools is essential for improving mining project performance and ensuring long-term success in the sector.

6.3 Quality Assurance Tools and Mining Project Performance

The survey findings highlight the crucial role of quality assurance tools in enhancing project performance and sustainability. Respondents strongly agreed on the effectiveness of these tools in improving efficiency, reducing errors, enhancing safety standards, and ensuring regulatory compliance. Continued investment in quality assurance tools and strategies, along with ongoing monitoring and evaluation, is essential for maintaining high performance standards and driving long-term success in mining projects in Rwanda and beyond.

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8. Conflict of interest statement

The author declares no conflicts of interest.

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