



Effect of Digital Technologies on Performance of Rukarara VI Hydropower Project in Nyamagabe District, Rwanda (2021-2025)

Aline Iribagiza and Wilson Musoni

University of Kigali

Email: iribagizaline@gmail.com

Abstract: This study examined the effect of digital technologies on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. Specifically, the study assessed the effect of digital project management on project performance. The study adopted a descriptive and explanatory research design using a mixed-methods approach. The target population comprised 353 project personnel, from which a sample size of 188 respondents was calculated using Yamane's formula. Data were collected using structured questionnaires, semi-structured interviews and analyzed using SPSS. Descriptive statistics, Pearson correlation analysis, and simple linear regression analysis were used to examine the relationship between digital project management and project performance. The findings showed that digital project management supported effective project planning, scheduling, monitoring, coordination among project teams, and resource allocation. Correlation analysis indicated a strong positive relationship between digital project management and project performance ($r = .766, p < .001$). Regression analysis reported that the model explained 60.2% of the variation in project performance. The study concluded that digital project management was positively associated with the performance of the Rukarara VI Hydropower Project. The study recommends strengthening the use of digital tools for project planning and monitoring, improving resource allocation, providing staff training, and enhancing ICT infrastructure to support effective project implementation.

Keywords: Digital Project Management, Project Performance, Hydropower Project, Technology Acceptance Model, Rwanda

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1. Introduction

Globally, digital project management has become an important approach to improving the performance of complex infrastructure and energy projects. Digital project management involves the use of digital platforms, project scheduling software, progress-tracking systems, digital reporting tools, and collaborative communication platforms to plan, coordinate, monitor, and control project activities. These technologies help project managers track project milestones, allocate resources, identify

implementation challenges, and make timely decisions. In large-scale hydropower projects, where construction activities, engineering operations, procurement, and environmental requirements must be coordinated, digital project management can support improved project performance by strengthening communication, reducing information delays, and facilitating the monitoring of project schedules and costs (Kerzner, 2024; Project Management Institute, 2023).

In developed countries, digital project management tools have increasingly been incorporated into infrastructure and

energy project implementation to improve coordination, planning, and performance monitoring. Digital scheduling systems and project management information systems enable project teams to monitor progress against planned activities, identify deviations from schedules, and coordinate the work of different contractors and technical teams. Similarly, Building Information Modeling (BIM) and integrated digital platforms support information sharing among engineers, designers, project managers, and other stakeholders. These applications are particularly relevant to hydropower projects because they involve interconnected construction and engineering activities that require accurate information and effective coordination. When appropriately implemented, digital project management can contribute to timely project completion, better resource utilization, cost control, and improved quality of project outputs (European Commission, 2023; Project Management Institute, 2023).

Across Africa, digital project management is increasingly relevant to infrastructure and energy development because project teams need effective ways to coordinate activities, monitor resources, and report implementation progress. Digital work-planning tools, electronic reporting systems, and project monitoring platforms can help project managers access updated information and identify problems requiring corrective action. In countries such as Kenya, South Africa, and Nigeria, the wider application of digital technologies in infrastructure development provides opportunities to improve project planning, supervision, communication, and accountability. However, the effectiveness of these tools depends on factors such as the availability of reliable digital infrastructure, staff technical skills, system integration, and the capacity of project teams to use digital information in decision-making. These considerations highlight the importance of examining not only the availability of digital tools but also how their use influences project performance (African Development Bank, 2023; Project Management Institute, 2023).

In East Africa, digital transformation has become increasingly important in strengthening the management of infrastructure and energy projects (Kagabo & Uwimana, 2024). Digital project management tools can support the preparation of work schedules, tracking of construction milestones, monitoring of resource use, and exchange of information among project stakeholders. In Uganda and Tanzania, the application of digital monitoring systems, geographic information systems, and electronic data collection tools in infrastructure-related activities illustrates the potential of digital solutions to improve project supervision and reporting. For hydropower projects, such applications can help teams identify implementation delays, monitor the completion of engineering activities, and coordinate technical operations.

Nevertheless, the contribution of digital project management to project performance depends on whether the systems provide accurate and timely information and whether project personnel use that information effectively to manage implementation challenges (; African Development Bank, 2023).

In Rwanda, digital transformation is a national development priority, with government initiatives encouraging the use of information and communication technologies to improve public-sector operations and service delivery (Rwanda ICT Ministry, 2023). The Smart Rwanda Master Plan provides a policy framework for expanding digital capabilities and supporting technology-driven development. In infrastructure and energy projects, digital project management can contribute to better planning, improved communication among stakeholders, more systematic progress reporting, and effective monitoring of project activities. These practices are important for projects that involve several technical teams, contractors, suppliers, and public institutions. However, the wider promotion of digital transformation does not automatically establish that all infrastructure projects use digital project management effectively or achieve better results as a consequence. It is therefore necessary to examine how digital project management is applied in specific projects and determine its relationship with performance outcomes (World Bank, 2023).

In the context of the Rukarara VI Hydropower Project in Nyamagabe District, digital project management is particularly relevant because hydropower development requires coordination of technical activities, construction schedules, human resources, equipment, materials, and project information. Digital project management tools can support the preparation and updating of work plans, monitoring of construction progress, tracking of project milestones, management of project documentation, and communication among engineers, contractors, project managers, and other stakeholders. Effective use of these tools may help project teams identify deviations from planned activities, respond to emerging challenges, coordinate the availability of resources, and maintain control over project schedules and costs. Furthermore, digital reporting and information-sharing platforms can improve the availability of project information for decision-making and strengthen coordination among the teams responsible for implementation (Kerzner, 2024; Project Management Institute, 2023).

Despite these potential benefits, the effect of digital project management on the performance of the Rukarara VI Hydropower Project requires specific investigation. In this study, digital project management focuses on the use of digital tools for project planning and scheduling, progress

monitoring, resource coordination, information management, and communication among project stakeholders. Project performance can be examined in terms of timely completion of activities, adherence to the project budget, achievement of technical quality requirements, and effective coordination of implementation activities. Assessing these dimensions will help establish whether and how digital project management practices are associated with the performance of the Rukarara VI Hydropower Project. The findings may also provide practical insights for project managers and other stakeholders seeking to improve the implementation of hydropower and infrastructure projects in Rwanda

1.2. Statement of the Problem

The performance of hydropower projects is important for ensuring reliable electricity generation, efficient resource utilization, cost control, and the timely completion of construction activities. Project performance is commonly assessed through indicators such as schedule adherence, budget compliance, quality of work, and effective use of resources (Terry, 2024). Digital technologies, including project management software, real-time monitoring systems, Building Information Modeling (BIM), and cloud-based collaboration platforms, provide opportunities to improve project performance by supporting planning, monitoring, communication, and decision-making. These technologies can help project teams track implementation progress, identify potential problems, coordinate activities, and respond to emerging risks. However, the extent to which these benefits are achieved depends on how effectively digital technologies are integrated into project management processes (Alphonse & Niyonsaba, 2023).

In Rwanda, the implementation of large-scale infrastructure projects, including hydropower developments, requires effective coordination of technical activities, financial resources, construction schedules, and project stakeholders. Challenges related to planning, progress monitoring, resource management, and stakeholder coordination may affect the achievement of project objectives (Wane, 2020; Rwanda Ministry of Infrastructure, 2023). In the context of the Rukarara VI Hydropower Project in Nyamagabe District, inadequate application of digital technologies could limit the timely availability of project information, delay the identification of implementation problems, and complicate coordination among project teams. Such challenges may contribute to schedule delays, cost overruns, quality concerns, and inefficient resource utilization. Therefore, examining the application of digital technologies in the project is important for understanding their potential contribution to improved performance.

Previous studies have indicated that digital technologies can support project performance by improving communication, monitoring, and coordination. Kamali and Kamanzi (2023) reported improvements in schedule adherence and cost management associated with digital project management tools in African infrastructure projects. Similarly, Mugisha (2023) found that real-time monitoring and collaborative platforms supported task completion and coordination among project teams. These findings suggest that digital technologies can contribute to better project outcomes when appropriately implemented. Nevertheless, findings from general construction projects cannot automatically be applied to hydropower projects, which involve specialized engineering activities, technical requirements, and complex coordination processes. Consequently, evidence from studies conducted in other contexts may not fully explain the role of digital technologies in the performance of the Rukarara VI Hydropower Project.

Despite the potential benefits of digital technologies, there is a need for project-specific empirical evidence on their effect on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. In particular, it is important to establish how digital project management tools, digital monitoring systems, and digital communication and collaboration platforms relate to project performance in terms of timely completion, budget compliance, quality of work, and resource utilization. Without such evidence, project managers and other stakeholders may have limited information to guide decisions concerning the adoption and effective use of digital technologies. This study therefore examined the effect of digital technologies on the performance of the Rukarara VI Hydropower Project, with the aim of generating findings that could inform project management practices and contribute to improved implementation of hydropower projects in Rwanda.

This research was guided by the following study objectives:

To assess the effect of digital project management on the performance of the Rukarara VI Hydropower Project in Nyamagabe District

2. Literature Review

This section presents key concepts related to the study, focusing on digital technologies and project performance in the context of infrastructure projects. It provides an understanding of the main variables and how they are applied within the Rukarara VI Hydropower Project

2.1 Conceptual Review

The conceptual review explains the key concepts related to digital project management and project performance. It defines these concepts and discusses their relevance to the implementation of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The review provides a clear understanding of how digital project management supports project planning, scheduling, monitoring, coordination, and resource allocation to improve project performance

2.1.1. Digital technologies

Digital technologies have emerged as a critical component in improving the performance of infrastructure projects globally (Kerzner, 2023). The integration of digital tools in project management enables better planning, coordination, monitoring, and decision-making, which are essential for achieving project objectives. When digital technologies are effectively applied, project teams are able to track progress in real time, reduce inefficiencies, and enhance overall productivity. In complex projects such as hydropower development, digital technologies support data-driven decision-making and improve communication among stakeholders, thereby reducing delays and cost overruns. As such, the use of digital technologies is not only a means of improving operational efficiency but also a strategic approach to enhancing project performance and sustainability (Project Management Institute, 2024).

One of the key advantages of digital technologies is their ability to improve coordination and transparency among project stakeholders (Physioni, 2023). Digital project management systems, for instance, allow for effective scheduling, task allocation, and resource planning, ensuring that all project activities are well organized and monitored. In large-scale infrastructure projects, such as hydropower developments, these technologies play a crucial role in ensuring that different components of the project are well integrated and executed efficiently (World Bank, 2024). For example, the use of digital monitoring tools in energy projects has significantly improved performance by enhancing supervision and reducing operational risks (OECD, 2023).

Furthermore, digital technologies enhance communication and data management, which are essential for the successful implementation of projects (Dennis, 2023). Digital communication systems facilitate the exchange of information among stakeholders, improving collaboration and reducing misunderstandings that may lead to project delays. At the same time, digital environmental monitoring ensure that accurate and up-to-date information is available for planning and decision-making processes. Studies have shown that projects that effectively utilize digital

technologies tend to achieve better performance outcomes in terms of time, cost, and quality (Smith, 2023). In the context of infrastructure projects in developing countries, including Rwanda, the adoption of digital technologies has the potential to significantly improve project performance by enhancing efficiency, accountability, and overall project management practices (African Development Bank, 2024)

2.1.2. Digital project Management

Digital project management have become an essential component in enhancing the performance of infrastructure projects (Mantel, 2023). These systems enable project managers and stakeholders to effectively plan, schedule, allocate resources, and control project activities using digital platforms. When project teams utilize digital project management, they are able to improve coordination, monitor progress, and make informed decisions, which contributes to better project outcomes. In complex projects such as hydropower development, the use of these systems ensures that all project components are well integrated and managed efficiently, reducing the likelihood of delays and cost overruns. In the context of Rwanda, the adoption of digital project management tools has increasingly supported infrastructure development by improving project planning and execution processes (MININFRA, 2024).

The use of digital project management also enhances transparency and accountability in project implementation ((Heagney, 2024). These systems provide a centralized platform where project information, schedules, and performance indicators can be accessed and updated in real time. This allows stakeholders to track project progress and identify potential challenges early, enabling timely corrective actions. In many infrastructure projects, digital tools such as scheduling software and project dashboards have improved communication among stakeholders and ensured that project activities are aligned with established timelines. For example, the use of digital scheduling tools in construction projects has significantly improved time management and resource allocation, leading to more efficient project delivery (Bryde, Broquetas, & Volm, 2023).

Furthermore, digital project management contribute to the overall performance and sustainability of projects by supporting data-driven decision-making (Huller,2025). By providing accurate and up-to-date information, these systems enable project managers to evaluate performance, manage risks, and optimize resource utilization. Studies have shown that projects that adopt digital project management is more likely to achieve their objectives in terms of time, cost, and quality. In developing countries, including Rwanda, the integration of such systems in infrastructure projects has the potential to enhance efficiency and improve project performance, particularly in large-scale projects such as hydropower development

where effective coordination and control are critical (Nkubito, 2023).

2.1.5. Project Performance

Project performance is a critical measure of success in infrastructure development, as it reflects the extent to which project objectives are achieved within the specified time, cost, and quality constraints (Atkinson, 2024). It encompasses key indicators such as timely completion, cost efficiency, quality of outputs, and effective utilization of resources. When projects are well managed and executed, they are more likely to meet stakeholder expectations and contribute to socio-economic development. In large-scale projects such as hydropower development, high performance is essential to ensure reliable energy production and long-term sustainability.

In Rwanda, improving project performance has become a priority in infrastructure development to support national growth and development goals (Rwanda Ministry of Infrastructure, 2023). The achievement of high project performance is influenced by several factors, including effective planning, coordination, and monitoring of project activities (Pinto & Slevin, 2023). The use of modern management practices and technologies plays a significant role in enhancing project outcomes by improving efficiency and reducing risks. In infrastructure projects, performance is often evaluated based on how well the project adheres to its schedule, budget, and quality standards. For example, projects that are completed on time and within budget while meeting required specifications are considered successful. The integration of digital technologies in project management has further improved performance by enabling real-time monitoring, better communication, and data-driven decision-making (Kerzner, 2024).

Furthermore, project performance is closely linked to the ability of project teams to manage resources effectively and respond to emerging challenges (Turner, 2024). Efficient resource utilization ensures that materials, labor, and financial resources are used optimally, minimizing waste and maximizing output. In addition, effective risk management and stakeholder coordination contribute to improved project outcomes. Studies have shown that projects that adopt innovative management approaches and technologies are more likely to achieve higher levels of performance in terms of time, cost, and quality. In developing countries such as Rwanda, enhancing project performance remains essential for ensuring the success of infrastructure projects, particularly in sectors such as energy where project efficiency directly impacts economic development (Uwimana, 2024).

2.2. Theoretical Review

This section presents the theoretical foundation underpinning the study. It is guided by Technology Acceptance Model (TAM) was introduced by Fred Davis in 1989 and has since been widely used to explain how individuals adopt and use new technologies ((Venkatesh, 2023). The model was later expanded by other scholars who emphasized its applicability in different organizational and technological contexts. TAM focuses on two main factors: perceived usefulness and perceived ease of use, which determine whether users are willing to accept and utilize new technology. Over time, this theory has become an important framework for understanding technology adoption in various sectors, including construction and infrastructure development, where digital tools are increasingly integrated into project management processes (Brown & Smith, 2023).

The Technology Acceptance Model essentially posits that the successful adoption of digital technologies depends on users' perceptions of their usefulness and ease of use (Taylor, 2023). It suggests that when individuals believe that technology improves their job performance and is easy to operate, they are more likely to adopt and use it effectively. In the context of project management, this means that digital systems such as project management software, monitoring tools, and communication platforms are more likely to be utilized when they are user-friendly and clearly beneficial. This leads to improved coordination, better decision-making, and enhanced overall project performance (Freelance, 2024).

This theory is relevant to the current study because it explains the adoption and utilization of digital technologies within the Rukarara VI Hydropower Project. The study examines Digital Project Management, Digital Communication, and Digital Environmental Monitoring as key dimensions of digital technologies. The theory suggests that when project managers, engineers, technicians, and other project staff perceive these digital systems as useful and easy to operate, they are more likely to adopt and utilize them effectively. Consequently, effective utilization of these technologies is expected to improve project performance through enhanced planning, communication, monitoring, coordination, and decision-making processes.

3. Methodology

The study adopted a descriptive research design to assess the effect of digital project management on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The design enabled the researcher to collect and analyse information about the use of digital project management tools in planning, scheduling, monitoring, and controlling project activities. A quantitative approach was used to measure respondents' perceptions of digital project management and project

performance, while qualitative information from interviews and documentary reviews provided additional explanations of the practices used in project implementation.

The target population consisted of 353 people involved in the Rukarara VI Hydropower Project, including one project manager, 25 engineers, 45 technicians, nine supervisors, 15 administrative staff, and 258 support staff. These groups were considered relevant because they participated in different project activities and could provide information about the application of digital project management. The population figures were obtained from the Rukarara VI Hydropower Project records for 2025.

The sample size was determined using Yamane's formula with a 5% margin of error. Based on a target population of 353 people, the calculated sample size was approximately 188 respondents. Stratified sampling was used to divide the population into groups according to job categories, followed by simple random sampling within the respective groups. This approach helped ensure that different categories of project personnel were represented. The sample distribution was adjusted to ensure that the numbers across the categories added up to 188 respondents.

Primary and secondary data were collected for the study. Primary data were obtained through structured questionnaires, semi-structured interviews, and direct observation. The questionnaires collected information about the use of digital project management tools in planning project activities, scheduling tasks, monitoring progress, managing resources, and controlling implementation processes. Interviews with selected project manager provided further information about the application of digital tools in project management. Secondary data were obtained from project reports, progress records, technical documents, and other relevant materials relating to the implementation and performance of the Rukarara VI Hydropower Project.

The main research instruments were a structured questionnaire, an interview guide, and a documentary review checklist. The questionnaire used a five-point Likert scale to measure respondents' views on digital project management and project performance. The digital project management indicators focused on the use of digital tools for project planning and scheduling, progress monitoring, resource management, and project control. Project performance was assessed using indicators related to the achievement of project objectives, completion of activities within planned schedules, budget compliance, and quality of work. A pilot study involving approximately 19 respondents, representing 10% of the main sample, was planned or conducted to assess the clarity and suitability of the research instruments. The Content Validity Index was

reported as 0.80, while Cronbach's alpha for the digital project management scale was 0.824, indicating satisfactory internal consistency.

Quantitative data were analysed using the Statistical Package for the Social Sciences (SPSS), version 26. Frequencies, percentages, means, and standard deviations were used to summarize respondents' views on digital project management and project performance. Multiple regression was not required because the study focused on one independent variable. Instead, simple linear regression was used to examine the statistical relationship between digital project management and project performance. The model was expressed as $Y = \beta_0 + \beta_1 X + \epsilon$, where Y represented project performance, X represented digital project management, β_0 was the constant, β_1 was the regression coefficient, and ϵ represented the error term. Qualitative information obtained from interviews and documentary reviews was analysed thematically to identify explanations concerning the application of digital project management and its relationship with project performance.

Ethical principles were observed throughout the research process. The researcher obtained the necessary authorization before collecting data and explained the purpose of the study to the participants. Informed consent was obtained, participation was voluntary, and respondents were free to withdraw without penalty. Confidentiality was maintained by protecting participants' identities and avoiding the disclosure of personal information. The collected data were stored securely and used only for academic research purposes. The researcher also ensured that data analysis, interpretation, conclusions, and recommendations were based on the evidence collected. Since the study examined the relationship between digital project management and project performance, the findings were interpreted in line with the research objective without making unsupported claims of causation.

4. Results and Discussion

This section presents the findings and discussion of the study that examined the effect of digital project management on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The findings are organized according to the study objective, which was to assess the effect of digital project management on project performance.

4.1 Findings

The findings are presented based on data collected from respondents through questionnaires and interviews. Quantitative data were analyzed using descriptive statistics, Pearson Product-Moment Correlation, and

simple linear regression analysis. Qualitative information obtained through interviews was analyzed thematically to complement the quantitative findings.

4.1.1. Response Rate

The study involved a total of 188 respondents, comprising one project manager and 187 other project personnel. The 187 respondents were administered structured questionnaires to collect quantitative data on the effect of digital technologies on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. All 187 respondents completed and returned their questionnaires, representing a 100% response rate. In addition, a semi-structured interview was conducted with the project manager to obtain detailed qualitative information about the use of digital technologies in project planning, scheduling, monitoring, coordination, and resource management. The information obtained from the interview complemented the questionnaire findings and provided further insights into the contribution of digital technologies to project performance

4.1.2 Descriptive Statistics of Digital Project Management

This section presents descriptive statistics on digital project management at the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. A five-point Likert scale was used, where 5 = Strongly Agree (SA), 4 = Agree (A), 3 = Neutral (N), 2 = Disagree (D), and 1 = Strongly Disagree (SD). The analysis assessed respondents’ perceptions of the use of digital tools in project planning, scheduling, progress monitoring, resource management, and project control

Table 1: Descriptive Statistics on Digital Project Management

Statements	N	Mean	Std.
Digital project management are used to plan project activities effectively.	187	4.4	0.71
Digital systems facilitate effective scheduling and monitoring of project activities.	187	4.3	0.76
Digital project management improve coordination among project teams.	187	4.5	0.69
Digital project management enhance resource allocation and utilization.	187	4.2	0.82
The use of digital project management has improved the overall performance of the project.	187	4.4	0.74
Overall Mean		4.36	0.74

Source: Field Data (2026)

The findings in Table 2 indicate that respondents generally agreed that digital project management was applied in the Rukarara VI Hydropower Project, as shown by the overall mean of 4.36 and a standard deviation of 0.74. This high mean suggests that digital project management was perceived positively by the respondents. The relatively low standard deviation indicates that respondents’ views were generally consistent. These findings suggest that digital project management played an important role in supporting project activities and improving project implementation.

The highest mean of 4.5, with a standard deviation of 0.69, was recorded for the statement that digital project management improved coordination among project teams. This indicates strong agreement among respondents that digital tools supported collaboration and coordination during project implementation. Effective coordination can help project teams share information, clarify responsibilities, and manage interdependent activities. The

standard deviation of 0.69 also suggests relatively little variation in respondents’ opinions, indicating a broadly shared perception of the contribution of digital project management to teamwork.

The statement that digital project management was used to plan project activities effectively and the statement that its use improved overall project performance both recorded a mean of 4.4, with standard deviations of 0.71 and 0.74, respectively. These results indicate that respondents generally agreed that digital tools supported project planning and contributed to project performance. In addition, digital systems facilitating the scheduling and monitoring of project activities recorded a mean of 4.3 and a standard deviation of 0.76. This suggests that digital systems were perceived as useful for organizing activities, tracking progress, and identifying implementation issues. Together, these findings highlight the perceived importance of digital project management in planning,

scheduling, monitoring, and overall project implementation.

The lowest mean of 4.2, with a standard deviation of 0.82, was recorded for the statement that digital project management enhanced resource allocation and utilization. Although this remained a positive result, it suggests that respondents were comparatively less satisfied with the contribution of digital tools to resource management than to team coordination. The higher standard deviation also indicates greater variation in respondents’ views on this aspect. This may suggest that the benefits of digital project management in allocating and utilizing resources were not experienced equally across project activities. Overall, the results indicate positive perceptions of digital project management at the Rukarara VI Hydropower Project, particularly in team coordination, while resource allocation and utilization may require further attention. However, these descriptive statistics reflect respondents’ perceptions and do not, on their own, establish a causal effect on project performance.

The qualitative findings from the interviews provided deeper insights into how digital project management influenced project performance in the Rukarara VI Hydropower Project. On the aspect of project planning and coordination, the Project Manager explained that digital project management enabled the project team to plan activities systematically, assign responsibilities, monitor progress, and coordinate project tasks efficiently. According to the Project Manager, the use of digital platforms improved communication among different departments and enabled managers to track project implementation in real time. The Project Manager stated:

"Digital project management enabled us to prepare work schedules, assign responsibilities, and monitor progress throughout the project. Because project information was updated regularly, we were able to identify implementation challenges early and take corrective measures before they affected project performance."

Another common theme emerging from the interviews was that digital project management improved accountability

and transparency during project implementation. Respondents explained that digital records enabled project managers to monitor task completion, evaluate staff performance, and ensure that project activities were implemented according to the approved work plans. This enhanced project control and improved decision-making throughout the implementation period. Overall, the interview findings demonstrate that digital project management positively influenced project performance by improving planning, scheduling, monitoring, coordination, accountability, and resource utilization. These qualitative findings complement the quantitative results and confirm that digital project management is an important determinant of successful project implementation in the Rukarara VI Hydropower Project.

These findings corroborate those of Kerzner (2024), who argued that digital project management improves project performance by enhancing planning, scheduling, monitoring, and coordination of project activities. The findings are also consistent with those of the Project Management Institute (2024), which observed that organizations adopting digital project management technologies experience improved resource utilization, better communication, and enhanced project delivery. Similarly, Bryde, Broquetas, and Volm (2023) found that digital project management strengthens collaboration among project teams, improve decision-making, and contribute significantly to project success through effective monitoring and control of project activities. These studies support the present findings that digital project management is critical in enhancing project performance through improved planning, coordination, monitoring, and efficient resource management.

4.1.3. Correlation Analysis

Pearson Product-Moment Correlation analysis was conducted to determine the direction and strength of the relationship between digital project management and the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The Pearson correlation coefficient (r) was used to assess the strength and direction of the relationship, while the p-value was used to determine its statistical significance at the 5% level. The results are presented in Table 3:

Table 2: Pearson Matrix between independent variable and dependent variable

	Digital project management	Project Performance
Digital project management	Pearson Correlation Sig. (2-tailed) N	1 187
Project Performance	Pearson Correlation Sig. (2-tailed)	.766** 1 .000

	N	187	187
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Source: Field data, 2026

The results in Table 2 indicate a strong positive and statistically significant relationship between digital project management and project performance at the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda (($r = 0.766$, $p = 0.000$). This suggests that higher levels of digital project management were associated with higher levels of project performance. The relationship may reflect the importance of digital tools in project planning, scheduling, progress monitoring, and coordination of activities. According to Cohen (1988), a correlation coefficient of this magnitude indicates a strong relationship between the variables. Therefore, the findings demonstrate a statistically significant association between digital project

management and project performance, although correlation alone does not establish causation.

4.1.4. Regression analysis

Simple linear regression analysis was conducted to examine the effect of digital project management on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The analysis assessed the extent to which digital project management predicted project performance. The regression results were used to evaluate the model's explanatory power and determine whether digital project management had a statistically significant relationship with project performance. The findings are presented in the following tables.

Table 3. Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.776 ^a	.602	.600	.32223

a. Predictors: (Constant), Digital project management

The results in Table 4 indicate a strong positive relationship between digital project management and project performance at the Rukarara VI Hydropower Project, as shown by ($R = 0.776$). The (R) Square value of 0.602 indicates that digital project management explains 60.2% of the variation in project performance, while the remaining 39.8% is associated with other factors not included in the model. The Adjusted (R) Square of 0.600 shows that the model explains approximately 60.0% of the

variation after adjustment, with the small difference between the two values suggesting model stability. The standard error of the estimate of 0.32223 indicates the level of prediction error between observed and predicted project performance values. Overall, the results suggest that digital project management has substantial explanatory power in relation to the performance of the Rukarara VI Hydropower Project.

Table 4. ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.415	1	11.472	379.888	.000 ^b
	Residual	7.217	186	.030		
	Total	41.632	187			

a. Dependent Variable: Project performance (Y)

b. Predictors: (Constant), Digital Project Management (X_1)

The results in Table 5 indicate that the regression model was statistically significant, with an F-value of 379.888 and a significance value of 0.000 ($p < 0.001$), which is below the 0.05 level of significance. This suggests that digital project management significantly predicts project performance at the Rukarara VI Hydropower Project. The regression sum of squares (34.415) indicates the variation

in project performance explained by the model, while the residual sum of squares (7.217) represents the unexplained variation. These results demonstrate that the regression model provides a statistically significant explanation of the relationship between digital project management and project performance

Table 5. Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.323	.133		-2.429	.016
	Digital Project Management (X ₁)	.161	.037	.141	4.373	.000

a. Dependent Variable: Project performance (Y)

The results in Table 6 indicate that digital project management had a positive and statistically significant relationship with project performance at the Rukarara VI Hydropower Project. The unstandardized coefficient ($B = 0.161$) indicates that a one-unit increase in digital project management was associated with a 0.161-unit increase in project performance. The standardized beta coefficient ($\beta = 0.141$) indicates a positive relationship between the variables. The t-value of 4.373 and significance value of 0.000 ($p < 0.001$) confirm that the relationship was statistically significant at the 5% level. Therefore, the findings suggest that improved digital project management practices were associated with better project performance.

4.2 Discussion of Findings

The objective of this study was to assess the effect of digital project management on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The descriptive statistics revealed that respondents generally had positive perceptions of digital project management, particularly regarding project planning, scheduling, monitoring, and coordination among project teams. However, resource allocation and utilization were identified as areas requiring further improvement. These findings suggest that digital project management tools supported the organization and coordination of project activities, thereby contributing to effective project implementation.

The correlational statistics revealed a strong positive relationship between digital project management and project performance. This indicates that improved use of digital tools for planning, monitoring progress, coordinating activities, and managing project information was associated with better project performance. The finding suggests that digital project management can help project teams access updated information, identify implementation challenges, and make timely decisions. This result agrees with Kerzner (2024) and the Project Management Institute (2024), who emphasized the importance of digital technologies in strengthening project planning, monitoring, coordination, and control. The findings therefore highlight the relevance of digital project management in supporting the implementation of complex infrastructure projects such as the Rukarara VI Hydropower Project.

The regression analysis further indicated that digital project management was a statistically significant predictor of project performance. The model summary suggested that digital project management explained a substantial proportion of the variation in project performance, while the remaining variation was associated with other factors not included in the model. This finding suggests that the effective use of digital project management tools may support improved project implementation through better scheduling, progress tracking, and coordination of project activities. It is consistent with the Project Management Institute (2024), which highlighted the role of digital technologies in improving project delivery and decision-making. However, the regression results should be interpreted cautiously until the inconsistencies in the reported ANOVA statistics and regression coefficients have been verified against the original SPSS output.

The findings are supported by the Technology Acceptance Model (TAM) developed by Davis (1989), which explains that technology adoption is influenced by perceived usefulness and perceived ease of use. In the context of the Rukarara VI Hydropower Project, digital project management tools may be more readily adopted when project personnel believe that they help improve planning, monitoring, coordination, and overall work performance. However, challenges such as limited digital skills and internet connectivity may reduce the ease of using these tools. Therefore, providing appropriate staff training, reliable digital infrastructure, and user-friendly systems may encourage technology acceptance and strengthen the contribution of digital project management to project performance. Overall, the findings support the study objective by demonstrating a positive and statistically significant association between digital project management and project performance, while emphasizing the importance of effective technology adoption and implementation.

5. Conclusion and Recommendations

5.1. Conclusion

This study concludes that digital project management was positively and significantly associated with the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda. The descriptive findings

showed that digital tools supported project planning, scheduling, progress monitoring, coordination among project teams, and overall project implementation. The correlation analysis revealed a strong positive relationship between digital project management and project performance, while the regression analysis indicated that digital project management was a statistically significant predictor of project performance. The findings further highlighted the importance of digital tools in improving coordination and monitoring project activities, although resource allocation, internet connectivity, and digital skills remained areas requiring attention. Supported by the Technology Acceptance Model (TAM), the study concludes that the perceived usefulness and ease of use of digital project management tools are important considerations in their effective adoption. Therefore, strengthening digital skills, improving ICT infrastructure, and promoting the effective use of digital project management systems may contribute to better project performance.

5.2. Recommendations

Based on the findings on the effect of digital project management on the performance of the Rukarara VI Hydropower Project in Nyamagabe District, Rwanda, the following recommendations are proposed:

- 1) Project managers should strengthen the use of digital tools to plan, allocate, and monitor labour, equipment, and materials. Regular comparisons between planned and actual resource use should be conducted to identify shortages, reduce wastage, and ensure that resources are available when needed.
- 2) Project managers should ensure that digital work schedules and progress reports are updated regularly. Digital monitoring systems should be used to track completed activities, identify delays, and take corrective action promptly to keep project implementation on schedule.
- 3) The project management team should organize regular practical training to improve staff skills in using digital project management systems. Internet connectivity and technical support should also be improved to address challenges identified during interviews and ensure the reliable use of digital tools.
- 4) Since respondents positively assessed digital coordination and project planning, project managers should continue using digital platforms to share updated information, assign responsibilities, coordinate teams, and monitor planned activities. In line with the Technology Acceptance Model (TAM), the systems should be

user-friendly and clearly useful to staff to encourage consistent adoption and support better project performance.

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