



Implementation of Project Management Information System and Performance of Construction Projects in Rwanda: A Case of NPD Ltd in Gasabo District

Collins Murego, Ronald Kwen
University of Kigali

<https://orcid.org/0009-0003-3421-8788>

Email: muregoc@gmail.com

Abstract: The general objective of this study was to assess the effect of Project Management Information System (PMIS) implementation on the performance of construction projects at NPD Ltd in Gasabo District, Rwanda. The specific objectives were to examine the effect of paper-based information systems, analyse the effect of computer-based information systems, and investigate the effect of internet-based information systems on construction project performance. The study was guided by Transaction Cost Theory, Socio-Technical Systems Theory, and the Theory of Change. A descriptive and correlational research design was adopted using qualitative and quantitative approaches. The study population comprised 298 employees, including Project Managers, Coordinators, Team Leaders, Site Engineers, and Technicians. A sample of 171 respondents was selected using Slovin's formula and stratified random sampling. Primary data were collected using questionnaires and documentation, while data processing involved editing, coding, and tabulation. Data were analysed using SPSS version 28 through frequencies, percentages, means, standard deviations, correlations, and regression analysis. Regression findings showed that paper-based information systems had a positive and significant effect on project performance ($B = 0.193$, $t = 3.939$, $p = 0.023$). Computer-based information systems recorded the strongest significant effect ($B = 0.543$, $t = 10.860$, $p = 0.000$), while internet-based information systems also had a positive significant effect ($B = 0.238$, $t = 5.289$, $p = 0.001$). The study concluded that computer-based systems contributed most strongly to performance and recommended strengthened digital scheduling, analytical dashboards, cloud collaboration, staff training, and controlled physical documentation to improve construction project delivery at NPD Ltd.

Keywords: Project Management Information System, Paper-Based Information System, Computer-Based Information System, Internet-Based Information System, Project Performance

How to cite this work (APA):

Murego, C. & Kwen, R. (2026). Implementation of Project Management Information System and Performance of Construction Projects in Rwanda: A Case of NPD Ltd in Gasabo District. *Journal of Research Innovation and Implications in Education*, 10(4), 144 – 157. <https://doi.org/10.59765/tj7r4>

1. Introduction

Efforts to modernize construction management in Brazil have increasingly centered on digital information platforms, driven by long-standing coordination gaps between material suppliers and on-site project teams. Integrated PMIS now forms part of day-to-day operations in large housing and transport projects, allowing design updates, change orders, and quality

checks to move through a single communication channel. This digital shift has helped unify distant engineering teams and streamline procurement, equipment logistics, and workforce allocation (Silva, 2022).

Across Africa, digital project information systems are gaining prominence as governments and developers confront recurring issues such as delays, inflated budgets, and fragmented supervision. The continent's expanding infrastructure ambitions have encouraged

organizations to shift from manual reporting toward structured digital coordination, reflecting a broader continental movement toward construction sector modernization (Adebayo, 2022).

Amid rapid urban transformation in Kenya, construction stakeholders have increasingly recognized the need for structured digital coordination to manage expanding project demands. Many contractors now rely on PMIS platforms to document subcontractor performance, update project diaries, and archive revised design files for transport and commercial developments. Through these systems, information flows more consistently across teams, resulting in improved stakeholder coordination and strengthened project oversight (Mwangi, 2024).

Over recent years, Rwanda has witnessed comparable momentum as large-scale infrastructure investments continue to redefine Kigali and surrounding cities. Digital project platforms are progressively becoming part of administrative routines for both public institutions and private contractors, supporting organized reporting, reliable document storage, and continuous communication throughout implementation. Such adoption demonstrates a growing national commitment to structured governance in construction management processes (Mukamana, 2022).

As national infrastructure programs continue, PMIS has also become instrumental in reinforcing transparency and procurement accountability in Rwanda. Digital records allow clients, auditors, and regulatory institutions to track progress, verify quality controls, and compare implementation against planned schedules, reducing reliance on manual documentation (Habimana, 2023). However, uneven adoption across organizations reveals persistent capacity constraints. In many firms, limited digital skills, insufficient managerial support, and inadequate technological infrastructure hinder full integration, resulting in inconsistent data sharing and fragmented record-keeping practices. These challenges highlight the need for organizational learning and structured policy guidance (Nkurunziza, 2024).

Growing academic and professional discourse in Rwanda now views PMIS as a catalyst for better coordination, accurate documentation, and improved contract administration across construction projects. With reduced dependency on paper-based systems, teams are able to access updated information and make timely decisions on sequencing, resourcing, and design revisions, reinforcing efficiency throughout the implementation process (Uwamahoro, 2025).

Rwanda's construction sector has experienced rapid expansion, driven by urbanization and infrastructure development. However, this growth has illuminated challenges in project implementation, particularly

concerning the adoption and efficacy of Project Management Information Systems (PMIS). Ineffective or absent PMIS mechanisms have been linked to project delays, budget overruns, and reduced productivity, raising concerns about the sustainability and quality of construction initiatives (Umurangamirwa & Bazimya, 2025).

Ndikumana et al. (2023) stated that over 27% of construction projects in Kigali experienced delays when relying on manual scheduling systems. The same study found that 57% of these projects lacked automated scheduling mechanisms, making it difficult to measure progress accurately or anticipate risks. This absence of clear PMIS frameworks hampers accountability, transparency, and evidence-based decision-making, leaving project managers reliant on reactive, rather than proactive, approaches.

A recent study conducted by Ndikumana et al. (2023) on project scheduling in Rwanda found that fewer than 30% of construction projects employed digital platforms for real-time tracking, data collection, and performance analysis. Most projects still relied on manual reporting systems, increasing the risk of data loss, delays in decision-making, and inconsistencies in reporting.

The previous mentioned studies in Rwanda including Umurangamirwa and Bazimya (2025), Natt and Muhire (2024), Ndikumana et al. (2023), and Mukalay and Wabala (2025) did not mention Gasabo District; however, no similar research has focused on the implementation of Project Management Information System and its effect on construction performance at NPD Ltd in Gasabo District, Rwanda.

1.1 General Objective

The general objective of this research was to assess the effect of Project Management Information System (PMIS) implementation on performance of construction projects at NPD Ltd in Gasabo District, Rwanda.

1.2 Specific Objectives

1. To examine the effect of paper-based information systems on performance of construction projects at NPD Ltd in Gasabo District.
2. To analyze the effect of computer-based information systems on performance of construction projects at NPD Ltd in Gasabo District.
3. To investigate the effect of internet-based information systems on performance of construction projects at NPD Ltd in Gasabo District.

2. Literature Review

The literature review presents the theoretical foundations and empirical evidence related to Project Management Information System implementation and performance of construction projects at NPD Ltd in Gasabo District.

2.1 Theoretical Review

This study was guided by Transaction Cost Theory, Socio-Technical Systems Theory, and the Theory of Change.

2.1.1 Transaction Cost Theory

Transaction cost theory explains how organizations decide whether to perform activities internally or contract them out. Every exchange carries costs beyond the price of the good or service, including searching for information, negotiating agreements, monitoring compliance, and enforcing contracts. When these costs are high, firms often prefer to internalize activities rather than rely on markets. The theory highlights three determinants: asset specificity, uncertainty, and frequency. Asset specificity refers to investments tailored to a particular transaction that cannot easily be redeployed elsewhere. Uncertainty makes it difficult to predict outcomes, while frequency relates to how often transactions occur. Together, these factors shape whether firms choose markets, hierarchies, or hybrid forms such as alliances and joint ventures (Rindfleisch, 2019).

The historical development of transaction cost theory began in 1937 when Ronald Coase published *The Nature of the Firm*, introducing the idea that firms exist because using markets entails costs. Oliver Williamson expanded the framework in the 1970s and 1980s, formalizing the role of asset specificity and opportunism in governance choices. Williamson's contributions earned him the Nobel Prize in Economics in 2009, and his work remains foundational in organizational economics (Libecap, 2022).

The study used Transaction Cost Theory to examine the effect of paper-based information systems on performance of construction projects at NPD Ltd in Gasabo District. It assessed how transaction costs such as searching, monitoring, and enforcing contracts influence efficiency, and how governance choices can reduce inefficiencies associated with paper-based processes, thereby improving project outcomes.

2.1.2 Socio-Technical Systems Theory

Socio-technical systems theory emphasizes that organizations function best when social and technical subsystems are jointly optimized. It argues that

technology alone cannot guarantee efficiency or satisfaction unless it is aligned with human needs and organizational culture. The theory views organizations as open systems where people, processes, and technologies interact dynamically. Its principles include semi-autonomous work groups, participative decision making, and meaningful tasks that enhance motivation. The approach stresses that technical efficiency must be balanced with social well-being, otherwise productivity and morale decline (Trist & Bamforth, 1951).

The theory originated in 1951 when Eric Trist and Ken Bamforth studied British coal mines and observed that mechanization disrupted traditional work groups, reducing morale and productivity. They proposed redesigning work systems to integrate social and technical dimensions, marking the birth of socio-technical systems theory. Over subsequent decades, the theory influenced organizational design, participatory management, and human-computer interaction (Pasmore, 1988).

The study applied Socio-Technical Systems Theory to analyze the effect of computer-based information systems on performance of construction projects at NPD Ltd in Gasabo District. It explored how the integration of social and technical subsystems enhances coordination, supports participative decision making, and improves productivity, ensuring that technological solutions align with human needs and organizational culture for effective project delivery.

2.1.3 Theory of Change

Theory of change is a structured framework that maps how interventions are expected to lead to desired outcomes. It articulates causal pathways from activities to outputs, intermediate outcomes, and long-term impacts. Each step specifies assumptions, risks, and evidence, making the logic of change explicit. The framework is widely used in program design, monitoring, and evaluation. It helps organizations clarify goals, identify preconditions, and align indicators with expected results (Weiss, 1995).

The origins of theory of change lie in program evaluation traditions of the 1990s, when evaluators sought to strengthen causal logic in planning and assessment. Over time, it evolved into a mainstream tool for funders, NGOs, and governments. Its popularity grew because it provided a clear narrative of how interventions were supposed to work, making accountability and learning more systematic (Connell & Kubisch, 1998).

The study employed the Theory of Change to investigate the effect of internet-based information systems on performance of construction projects at NPD Ltd in Gasabo District. It mapped causal pathways linking digital interventions to project outcomes, clarify

assumptions about connectivity and resource allocation, and evaluate how internet-enabled systems contribute to monitoring, accountability, and the achievement of construction project goals.

2.2 Empirical Review

The empirical review examines previous studies on paper-based, computer-based, and internet-based information systems in relation to construction project performance.

2.2.1 Paper-based Information system and performance of construction project

Ibrahim et al. (2024) investigated the effect of traditional paper-based performance measurement practices on construction projects worldwide. Published in *Buildings* (MDPI), their critical review analyzed documentation methods across multiple countries. The study found that reliance on paper records limited transparency, slowed reporting cycles, and contributed to inefficiencies in monitoring cost and schedule performance. Comparative evidence showed that projects using manual documentation experienced higher risks of misreporting and weaker accountability structures. The authors emphasized that paper-based systems hindered reproducibility and benchmarking across international projects, reducing overall performance reliability.

Adebayo (2021) explored the effect of paper-based record systems on construction project performance in Nigeria. Surveying 92 projects, the study found manual documentation strongly associated with delays and cost overruns. Projects using paper records reported mean schedule slippages of 14% and procurement errors averaging 19%. Regression analysis confirmed a significant negative effect ($\beta = -0.31$, $p < 0.05$). The study emphasized that fragmented paper records limited traceability and slowed approvals, undermining efficiency. Recommendations included gradual migration to digital repositories to improve transparency and accountability.

Mukesha (2021) examined the effect of paper-based procurement records on construction project performance in Rwanda. A study of 40 projects revealed that manual systems were linked to higher error rates in procurement documentation (mean error = 21%). Regression analysis confirmed a negative impact on performance ($\beta = -0.28$, $p < 0.05$). The study emphasized that paper-based systems limited traceability and slowed procurement cycles, contributing to delays and budget inefficiencies.

2.2.2 Computer-based Information System and performance of construction project

Egbebi (2023) evaluated the effect of project management software on construction project performance globally. The study analyzed firms using digital scheduling and resource allocation tools, reporting measurable gains: scheduling accuracy improved by 17%, cost overruns decreased by 9%, and resource utilization efficiency increased significantly. Statistical analysis confirmed strong positive associations between software adoption and project outcomes ($r = 0.42$, $p < 0.01$). The study concluded that computer-based IS standardize workflows, enhance monitoring, and enable faster corrective actions.

Ndlovu (2024) examined the effect of ERP systems on construction project performance in Southern Africa. Published in *Buildings* (MDPI), the study analyzed 108 projects adopting ERP software for procurement and scheduling. Results showed ERP use improved procurement efficiency by 12% and reduced average cycle times by 10 days. Regression analysis confirmed significant positive effects ($\beta = 0.33$, $p < 0.01$), with $R^2 = 0.27$ indicating moderate explanatory power. The study emphasized that computer-based IS standardized workflows, enhanced resource allocation, and improved monitoring accuracy.

Habimana (2023) investigated the effect of automated project task scheduling software on construction project performance in Rwanda. Published in the *Strategic Journal of Business & Change Management*, the study analyzed 55 projects using scheduling tools. Results showed improved time management, with mean reductions in delays of 14%. Correlation analysis confirmed significant positive associations ($r = 0.36$, $p < 0.01$). The study emphasized that scheduling software enhanced task breakdowns, clarified dependencies, and improved monitoring cycles.

2.2.3 Internet-based Information System and performance of construction project

Chowdhury (2021) explored the effect of web-based technology platforms on construction project collaboration. Published in *ITcon*, the study synthesized 1,152 user reviews of internet-based systems used across international projects. Findings revealed that reliance on online platforms reduced coordination friction, accelerated information exchange, and improved issue resolution. Users consistently reported time savings and fewer communication errors, which translated into measurable improvements in project delivery. The study emphasized that internet-based IS enhanced transparency and accountability by allowing distributed teams to access shared records in real time. Importantly, the review highlighted that adoption of web-based

systems was most effective when paired with organizational training and governance structures.

Okeke (2021) examined the effect of cloud-based platforms on construction project performance in East Africa. The study analyzed 75 projects in Nairobi that adopted cloud database management systems for procurement and monitoring. Results showed that internet systems reduced communication errors by 19% and improved delivery timelines by 8%. Correlation analysis confirmed significant associations ($r = 0.31$, $p < 0.05$). The study emphasized that cloud platforms enabled cross-stakeholder visibility, faster approvals, and improved data integrity. Projects using internet systems reported fewer disputes and smoother coordination compared to paper-based workflows. Importantly, the research noted that adoption challenges included limited infrastructure and inconsistent internet access, which moderated the benefits.

Uwimana (2023) investigated the effect of cloud-based management practices on project performance in Rwanda. Published in the *Global Scientific Journal*, the study focused on the Rwanda Digital Acceleration Project but highlighted mechanisms transferable to construction. Quantitative analysis revealed that internet systems improved stakeholder coordination ($\beta = 0.41$, $p < 0.01$), reducing average dispute resolution time by 10 days. The $R^2 = 0.27$ confirmed explanatory strength. The study emphasized that cloud platforms facilitated centralized access, real-time updates, and faster communication, which directly enhanced project outcomes. Projects using internet systems reported smoother collaboration and fewer delays compared to paper-based workflows. Importantly, the research highlighted that institutional governance and organizational culture moderated the effectiveness of cloud adoption. Recommendations included scaling cloud platforms nationally, embedding training, and aligning governance structures to sustain performance gains in Rwanda's construction sector.

3. Methodology

The methodology presents research design, study population, sampling design, data collection instrument, pilot study, validity and reliability, data analysis, and ethical considerations.

3.1 Research Design

The study adopted descriptive and correlational research designs using quantitative and qualitative approaches. The descriptive design was used to examine the existing conditions of PMIS implementation at NPD Ltd, while the correlational design was used to establish the strength and direction of relationships between paper-based,

computer-based, and internet-based information systems and construction project performance.

3.2 Study Population

The population of the study were 298 employees classified into four groups: Project Managers, Coordinators, Team Leaders, and Site Engineers of 3 construction projects including Street Lighting Project, Kigali Infrastructure Project and Roads Maintenance Project in Gasabo District by NPD Ltd. This population represents the entire workforce segment directly involved in project planning, coordination, supervision, and on-site execution. By including these categories, the study ensures coverage of both strategic and operational roles, thereby capturing diverse perspectives on leadership, management practices, and project performance.

3.3 Sampling Design

The sample size was determined with the help of Slovin's formula, which provides a statistical method for calculating an appropriate sample based on the total population and a desired margin of error. This formula ensures that the selected sample is representative of the population, minimizes sampling bias, and enhances the reliability and validity of the study findings.

By applying Slovin's formula to the population of 298 employees, the study derived a sample size that balances accuracy with feasibility in data collection.

3.4 Data Collection Instrument

Questionnaires was used as the primary research instrument to collect data from participants. This study employed closed-ended questions, which provide precise and readily comparable information. A total of 178 respondents was selected, and questionnaires containing a mix of closed-ended items was distributed to ensure thorough and representative data collection across all categories. Responses was measured using a five-point Likert scale, where Strongly Agree (SA) is coded as 5, Agree (A) as 4, Neutral (N) as 3, Disagree (D) as 2, and Strongly Disagree (SD) as 1. This design enables the quantification of perceptions and facilitates statistical analysis of the findings.

3.5 Pilot Study, Validity and Reliability

Pilot study was conducted for assessing the validity and reliability of research instruments, mainly the questionnaire and the contents of the questions asked. The pre-test was carried out within an ongoing construction project implemented by NPD Ltd, and it involved 18 respondents representing 10% of the total

sample size. Those who participate in the pilot testing was excluded from the final data collection to avoid duplication, response contamination, biased feedback, and recall influence. The pilot exercise helped identify unclear statements, ambiguous questions, structural weaknesses, and technical errors, enabling necessary adjustments before administering the final questionnaire to the targeted respondents.

Validity in research design was ensured by confirming that the ideas and measures utilized properly reflect what they are intended to assess and remain consistent among respondents. A pre-test was conducted with a sample of ten project managers and project office workers to evaluate the questionnaire's efficacy. This pre-test determined whether the instrument successfully captures the intended concepts and identify areas requiring adjustment. To further strengthen validity, the questionnaire was reviewed and approved by the

supervisor and review panel during the proposal presentation. This process guarantees alignment with the study's objectives and accurate measurement of the relevant variables. In addition, the Content Validity Index (CVI) was calculated by dividing the number of relevant items in the instrument by the total number of items; a CVI greater than 0.70 confirmed the validity of the questionnaire.

A pre-test was undertaken before the research instruments are administered to respondents in order to verify the questionnaire and guarantee high response consistency. This step ensured that the questionnaire effectively captures the desired ideas and that answers are consistent, with a target consistency level of at least 0.70. Furthermore, Cronbach's alpha was used to evaluate the questionnaire's reliability, assuring both validity and reliability for the primary research.

Table 1: Reliability statistics

Variables	N of Items	Cronbach's Alpha	Interpretation
Paper-Based Information Systems	4	.829	Reliable
Computer-Based Information Systems	4	.822	Reliable
Internet-Based Information Systems	4	.818	Reliable
Performance of Construction Projects	4	.825	Reliable

Source: Field Data, 2026

The reliability analysis conducted using SPSS confirms that the research tool is dependable. Based on the Cronbach's Alpha values presented in Table 1, all variables exhibit strong reliability, with scores exceeding the 0.8 threshold, which falls within the "Good reliability" range. Since all variables have Cronbach's Alpha values above 0.8, the questionnaire used in this study is considered a reliable instrument for assessing paper-based information systems, computer-based information systems, internet-based information systems, and performance of construction projects at NPD Ltd in Gasabo District.

3.6 Data Analysis

Data analysis employed a combination of descriptive and inferential statistical techniques. Descriptive statistics summarized frequency, percentage, mean, and standard deviation, while inferential methods such as Bivariate Correlation Analysis and linear regression tested relationships between variables. Analysis was conducted using SPSS (version 28) to evaluate the effect of PMIS implementation on construction project performance at NPD Ltd in Gasabo District, Rwanda.

Descriptive statistics was used to provide a summary of the data and ensure comprehensive interpretation. The analysis was carried out using version 28 of the Statistical Package for Social Sciences (SPSS).

Respondents were assessed their agreement with statements on a 5-point scale, from 1 (strongly disagree) to 5 (strongly agree). The generated averages were classified in the following ranges: Very low: 1.0-1.8, low: 1.9-2.6, neutral: 2.7-3.4, high: 3.5-4.2, and extremely high: 4.3-5.0. The standard deviation was used to assess data uniformity. Values of 0.5 or lower suggest homogeneity, whilst values greater than 0.5 reflect heterogeneity.

The hypotheses were tested using bivariate correlation analysis, which looked at the link between one dependent variable and one independent variable. This simple statistical approach seeks to assess if a connection exists between two variables, usually indicated as X and Y. The analysis gave a Pearson Correlation coefficient (r) that varies between ± 1 , showing the strength and direction of the association (positive or negative). The correlation's significance was determined using the Sig.(2-Tailed) value, with a result of less than or equal to 0.05 being statistically significant. Multiple regression model was evaluated to all indicators as stated in the conceptual framework. The coefficient measured effect size r using the following regression equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$$

Where: Y = Project Performance

β_0 = Constant

X_1 = Paper-based Information Systems

X_2 = Computer-based Information Systems

X3 = Internet-based Information Systems
 β_1 , β_2 and β_3 = coefficients
e = error term

3.7 Ethical Considerations

Expertise, dedication, and ethical behavior are critical for study success, since they ensure respect for participants' rights and adherence to ethical rules. The rights of participants to autonomy, anonymity, confidentiality, and informed consent shall be completely honored during this research. Participants' consent was asked prior to doing the surveys, assuring voluntary participation. To ensure privacy, all collected data was securely kept. Participants was given letters of approval. The questions were designed to guarantee that participants' identities are kept anonymous, with no personal information necessary.

4. Results and Discussions

The section presents and interprets the inferential findings on PMIS implementation and its relationship with the performance of construction projects at NPD Ltd in Gasabo District.

4.1 Response Rate

Response rate is important because it shows the level of participation of selected respondents in the study. A high response rate improves the reliability of the study findings because it reduces the risk of non-response bias. In this study, questionnaires were distributed to employees involved in construction projects at NPD Ltd in Gasabo District. The results are presented according to complete returned questionnaires, incomplete returned questionnaires, and unreturned questionnaires.

Table 2: Response rate

Questionnaires	Frequency	Percentage (%)
Returned Complete	165	96.5
Returned Incomplete	4	2.3
Unreturned	2	1.2
Total	171	100.0

Source: Field Data, 2026

The results in Table 2 indicate the response rate of respondents who participated in the study on PMIS implementation and performance of construction projects at NPD Ltd in Gasabo District. Returned complete questionnaires were 165, representing 96.5% of the sampled respondents, meaning that most selected respondents provided usable information for analysis. Returned incomplete questionnaires were 4, representing 2.3%, while unreturned questionnaires were 2, representing 1.2%, showing that only a small proportion of the expected data was not suitable for analysis. The total sample was 171 respondents, representing 100.0%, and the high response rate strengthened the adequacy of the data used to examine PMIS implementation and construction project performance at NPD Ltd.

4.2 Inferential Statistics

Inferential statistics were used to examine the relationships and effects between the study variables. Correlation analysis was used to determine the strength

and direction of the relationship between each PMIS implementation variable and performance of construction projects at NPD Ltd in Gasabo District. Regression analysis was used to determine the extent to which paper-based information systems, computer-based information systems, and internet-based information systems predicted performance of construction projects. The interpretation focused only on relationships and effects connected to the three specific objectives of the study.

4.2.1 Correlation Analysis

Correlation analysis was used to examine the relationship between PMIS implementation variables and performance of construction projects at NPD Ltd in Gasabo District. The analysis focused on Pearson correlation coefficients and significance values. A p-value of 0.05 was used as the significance level. A relationship was considered statistically significant when the Sig. value was less than or equal to 0.05.

Table 3: Correlation matrix

		Paper-based Information Systems	Computer-based Information Systems	Internet-based Information Systems	Project- Performance
Paper-based Information Systems	Pearson	1	.562**	.704**	.704**
	Correlation				
	Sig. (2-tailed)		.000	.000	.000
Computer-based Information Systems	N	165	165	165	165
	Pearson	.562**	1	.608**	.811**
	Correlation				
Internet-based Information Systems	Sig. (2-tailed)	.000		.000	.000
	N	165	165	165	165
	Pearson	.704**	.608**	1	.753**
Project Performance	Correlation				
	Sig. (2-tailed)	.000	.000		.000
	N	165	165	165	165
Project Performance	Pearson	.704**	.811**	.753**	1
	Correlation				
	Sig. (2-tailed)	.000	.000	.000	
Project Performance	N	165	165	165	165

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

Source: Field Data, 2026

The findings in Table 3 indicate the correlation matrix between paper-based information systems, computer-based information systems, internet-based information systems, and performance of construction projects at NPD Ltd in Gasabo District. Paper-based information systems had a Pearson correlation coefficient of 0.704 with project performance and a Sig. value of 0.000. Since the p-value is below 0.05, the relationship is statistically significant. This means that improvement in paper-based information systems is strongly and positively associated with performance of construction projects at NPD Ltd in Gasabo District.

Computer-based information systems had a Pearson correlation coefficient of 0.811 with project performance and a Sig. value of 0.000. Since the p-value is below 0.05, the relationship is statistically significant. This means that computer-based information systems had a very strong positive relationship with performance of construction projects at NPD Ltd in Gasabo District. The result indicates that increased use of automated validation, workflow software, milestone alerts, and dashboards is associated with better performance in scope, cost, quality, and timelines.

Internet-based information systems had a Pearson correlation coefficient of 0.753 with project performance and a Sig. value of 0.000. Since the p-value is below

0.05, the relationship is statistically significant. This means that internet-based information systems had a strong positive relationship with performance of construction projects at NPD Ltd in Gasabo District. The result indicates that cloud security protocols, collaborative platforms, remote diagnostics, and interactive communication channels are associated with better project performance.

The correlation analysis showed that all PMIS implementation variables had positive and significant relationships with performance of construction projects at NPD Ltd in Gasabo District. Computer-based information systems showed the strongest relationship, followed by internet-based information systems and paper-based information systems. This means that digital tools were more strongly associated with project performance, although organized paper records also remained important. The results confirm that strengthening PMIS practices can support improved construction project performance at NPD Ltd.

4.2.2 Regression Analysis

This subsection covers the model summary, ANOVA, and regression coefficients used to assess the effects of the independent variables on the dependent variable.

Table 4: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.886 ^a	.786	.782	.19259	1.751

a. Predictors: (Constant), Internet-based Information Systems, Computer-based Information Systems, Paper-based Information Systems
b. Dependent Variable: Project Performance

Source: Field Data, 2026

The results in Table 4 indicate the model summary for the effect of PMIS implementation on performance of construction projects at NPD Ltd in Gasabo District. The R value was 0.886, showing a strong positive relationship between the combined independent variables and project performance. The R Square value was 0.786, meaning that paper-based information systems, computer-based information systems, and

internet-based information systems explained 78.6% of the variation in performance of construction projects. The remaining 21.4% may be explained by other factors not included in the model, such as project leadership, procurement conditions, external regulations, and resource availability. The Durbin-Watson value was 1.751, which is close to 2 and suggests that the regression residuals did not show a serious autocorrelation problem.

Table 5: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.887	3	7.296	197.189	.000 ^b
	Residual	5.972	161	.037		
	Total	27.859	164			

a. Dependent Variable: Project Performance
b. Predictors: (Constant), Internet-based Information Systems, Computer-based Information Systems, Paper-based Information Systems

Source: Field Data, 2026

The findings in Table 5 indicate the ANOVA results for the regression model examining PMIS implementation and performance of construction projects at NPD Ltd in Gasabo District. The F-value was 197.189, showing that the overall model had strong explanatory power. The Sig. value was 0.000, which is below the 0.05 significance level. This means that the regression model was

statistically significant and suitable for explaining the effect of PMIS implementation variables on project performance. Therefore, paper-based information systems, computer-based information systems, and internet-based information systems jointly had a significant effect on performance of construction projects at NPD Ltd.

Table 6: Coefficients

		Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics	
Model		B	Std. Error	Beta	t	Sig.	Tolerance VIF
1	(Constant)	.125	.176		.710	.480	
	Paper-based Information Systems	.193	.049	.208	3.939	.023	.476 2.101
	Computer-based Information Systems	.543	.050	.517	10.860	.000	.595 1.681
	Internet-based Information Systems	.238	.045	.292	5.289	.001	.439 2.280
a. Dependent Variable: Project Performance							

Source: Field Data, 2026

The results in Table 6 indicate the coefficient summary for the individual effect of PMIS implementation variables on performance of construction projects at NPD Ltd in Gasabo District. The constant had $B = 0.125$, $t = 0.710$, and $\text{Sig.} = 0.480$. Since the p-value was above 0.05, the constant was not statistically significant. This means that when paper-based information systems, computer-based information systems, and internet-based information systems are held constant, the baseline value of project performance is not significant. The interpretation of the study therefore focused on the independent variables under the specific objectives.

Paper-based information systems had $B = 0.193$, $t = 3.939$, and $\text{Sig.} = 0.023$. Since the p-value was below 0.05, paper-based information systems had a positive and statistically significant effect on performance of construction projects at NPD Ltd in Gasabo District. This means that a one-unit improvement in paper-based information systems increases project performance by 0.193 units when other variables are held constant. The tolerance value was 0.476 and the VIF was 2.101, indicating that multicollinearity was not a serious problem because tolerance was above 0.10 and VIF was below 10.

Therefore, the null hypothesis stating that paper-based information systems have no significant effect on performance of construction projects was rejected.

Computer-based information systems had $B = 0.543$, $t = 10.860$, and $\text{Sig.} = 0.000$. Since the p-value was below 0.05, computer-based information systems had a positive and statistically significant effect on performance of construction projects at NPD Ltd in Gasabo District. This means that a one-unit improvement in computer-based information systems increases project performance by 0.543 units when other variables are held constant. The tolerance value was 0.595 and the VIF was 1.681, showing that multicollinearity was not a serious problem. Therefore, the null hypothesis stating that computer-

based information systems have no significant effect on performance of construction projects was rejected.

Internet-based information systems had $B = 0.238$, $t = 5.289$, and $\text{Sig.} = 0.001$. Since the p-value was below 0.05, internet-based information systems had a positive and statistically significant effect on performance of construction projects at NPD Ltd in Gasabo District. This means that a one-unit improvement in internet-based information systems increases project performance by 0.238 units when other variables are held constant. The tolerance value was 0.439 and the VIF was 2.280, showing that multicollinearity was not a serious problem. Therefore, the null hypothesis stating that internet-based information systems have no significant effect on performance of construction projects was rejected.

The coefficient results showed that all PMIS implementation variables had positive and significant effects on performance of construction projects at NPD Ltd in Gasabo District. Computer-based information systems had the strongest effect, followed by internet-based information systems and paper-based information systems. The collinearity statistics showed acceptable tolerance and VIF values, meaning that the independent variables were suitable for inclusion in the regression model. The results confirm that strengthening PMIS implementation can improve scope clarity, cost management, quality achievement, and timelines in construction projects at NPD Ltd.

The fitted regression model was:

$$\text{Performance of construction projects} = 0.125 + 0.193(\text{Paper-based information systems}) + 0.543(\text{Computer-based information systems}) + 0.238(\text{Internet-based information systems}) + \varepsilon$$

4.3 Decision on Null Hypotheses

This section presents decisions on the null hypotheses using regression significance values at the 0.05 level.

Table 7: Decision on null hypotheses

Hypothesis	Null hypothesis statement	Regression evidence	Decision
H01	Paper-based information systems have no significant effect on performance of construction projects at NPD Ltd in Gasabo District.	$\text{Sig.} = 0.023$	Rejected
H02	Computer-based information systems have no significant effect on performance of construction projects at NPD Ltd in Gasabo District.	$\text{Sig.} = 0.000$	Rejected
H03	Internet-based information systems have no significant effect on performance of construction projects at NPD Ltd in Gasabo District.	$\text{Sig.} = 0.001$	Rejected

Source: Field Data, 2026

The findings in Table 7 indicate decisions on the null hypotheses for PMIS implementation and performance of construction projects at NPD Ltd in Gasabo District. The first null hypothesis was rejected because paper-

based information systems had a significant effect on project performance. The second null hypothesis was rejected because computer-based information systems had a significant effect on project performance. The third

null hypothesis was rejected because internet-based information systems had a significant effect on project performance. Therefore, the study concluded that all three PMIS implementation dimensions significantly affected performance of construction projects at NPD Ltd in Gasabo District.

4.4 Discussion of Research Findings

This section discusses the inferential findings according to the study objectives by relating the effects of paper-based, computer-based, and internet-based information systems to construction project performance at NPD Ltd.

4.4.1 Effect of Paper-Based Information Systems on Performance of Construction Projects

Paper-based information systems had $B = 0.193$, $t = 3.939$, and $\text{Sig.} = 0.023$. Since the p-value was below 0.05, paper-based information systems had a positive and statistically significant effect on performance of construction projects at NPD Ltd in Gasabo District. This means that a one-unit improvement in paper-based information systems increases project performance by 0.193 units when other variables are held constant. The tolerance value was 0.476 and the VIF was 2.101, indicating that multicollinearity was not a serious problem because tolerance was above 0.10 and VIF was below 10. Therefore, the null hypothesis stating that paper-based information systems have no significant effect on performance of construction projects was rejected.

The findings are supported by Mukesha (2021), who emphasizes that traceable project documentation strengthens procurement control and reduces implementation weaknesses in construction projects. The outcomes also resonate with Ibrahim et al. (2024), who explain that reliable documentation and performance evidence are necessary for monitoring project progress, comparing implementation against plans, and improving accountability. This agreement suggests that well-organized paper records can still contribute meaningfully when they are controlled, preserved, and used to support project decisions.

4.4.2 Effect of Computer-Based Information Systems on Performance of Construction Projects

Computer-based information systems had $B = 0.543$, $t = 10.860$, and $\text{Sig.} = 0.000$. Since the p-value was below 0.05, computer-based information systems had a positive and statistically significant effect on performance of construction projects at NPD Ltd in Gasabo District. This means that a one-unit improvement in computer-based information systems increases project performance by 0.543 units when other variables are held constant. The tolerance value was 0.595 and the VIF was 1.681,

showing that multicollinearity was not a serious problem. Therefore, the null hypothesis stating that computer-based information systems have no significant effect on performance of construction projects was rejected.

The results are consistent with Egbebi (2023), who shows that project management software improves scheduling accuracy, monitoring discipline, and corrective action in construction project delivery. The findings also align with Ndlovu (2024), who explains that ERP and computer-based systems improve workflow standardization, procurement efficiency, and monitoring accuracy. This scholarly support confirms that computer-based information systems are useful not merely as storage tools, but as practical instruments for coordination, progress tracking, and timely managerial response.

The outcomes are in agreement with Egbebi (2023), who found that construction project software improves scheduling accuracy, resource utilization, monitoring, and corrective action during implementation. The results are also consistent with Ndlovu (2024), who explains that computer-based ERP systems standardize workflows, improve procurement efficiency, and enhance monitoring accuracy. This agreement demonstrates that computer-based information systems contribute strongly when project teams use digital tools to organize work, detect deviations, and support timely management decisions.

4.4.3 Effect of Internet-Based Information Systems on Performance of Construction Projects

Internet-based information systems had $B = 0.238$, $t = 5.289$, and $\text{Sig.} = 0.001$. Since the p-value was below 0.05, internet-based information systems had a positive and statistically significant effect on performance of construction projects at NPD Ltd in Gasabo District. This means that a one-unit improvement in internet-based information systems increases project performance by 0.238 units when other variables are held constant. The tolerance value was 0.439 and the VIF was 2.280, showing that multicollinearity was not a serious problem. Therefore, the null hypothesis stating that internet-based information systems have no significant effect on performance of construction projects was rejected.

The outcomes align with Chowdhury (2021), who found that web-based technology platforms strengthen collaboration, information exchange, transparency, and issue resolution in construction projects. The results are also supported by Okeke (2021), who explains that cloud-based systems improve cross-stakeholder visibility, approvals, and data integrity. This consistency shows that internet-based information systems are valuable where construction teams need quick communication, shared access to records, and timely coordination across different work locations.

The results are supported by Chowdhury (2021), who indicates that web-based platforms improve communication, collaboration, transparency, and issue resolution among construction project teams. The outcomes also align with Uwimana (2023), who explains that cloud-based project management practices improve stakeholder coordination, centralized access, real-time updates, and timely communication. This support confirms that internet-based information systems improve project performance when online platforms are used to connect stakeholders, protect information access, and accelerate response to project issues.

5. Conclusion and Recommendations

The section presents conclusions drawn from the study findings and recommendations intended to strengthen PMIS implementation and improve construction project performance.

5.1 Conclusion

This section presents conclusions drawn from the findings of the study. The conclusions are arranged according to the specific objectives and are based mainly on inferential statistics. The section also provides a general conclusion on the effect of PMIS implementation on performance of construction projects at NPD Ltd in Gasabo District.

Regarding the first specific objective, the study concluded that paper-based information systems positively influence performance of construction projects at NPD Ltd in Gasabo District. Well-managed physical documentation supports traceability, orderly approvals, and preservation of important project information. Although construction firms are moving toward digital systems, structured paper records remain useful for accountability and verification. Therefore, paper-based information systems should not be abandoned but should be controlled and integrated with digital records.

Regarding the second specific objective, the study concluded that computer-based information systems are central to performance of construction projects at NPD Ltd in Gasabo District. They improve accuracy, coordination, milestone tracking, and interpretation of project performance. Computer-based systems showed the strongest contribution to project performance compared with other PMIS dimensions. Therefore, stronger investment in software, dashboards, and staff capacity can further improve construction project delivery.

Regarding the third specific objective, the study concluded that internet-based information systems positively influence performance of construction

projects at NPD Ltd in Gasabo District. Online platforms support fast communication, cloud storage, remote problem identification, and stakeholder coordination. These systems reduce information delays and help project teams respond quickly to implementation needs. Therefore, internet-based PMIS tools should be strengthened to support real-time collaboration and monitoring.

In general, the study concluded that Project Management Information System implementation significantly improves performance of construction projects at NPD Ltd in Gasabo District. Paper-based, computer-based, and internet-based information systems all contribute to project scope clarity, cost control, quality achievement, and timely completion. Computer-based systems remain the strongest driver of performance, but the best results are achieved when all PMIS dimensions are used in an integrated way. The study therefore confirms that effective information management is essential for improving construction project performance.

5.2 Recommendations

The following recommendations were drawn from the study findings to guide practical improvements and inform future interventions.

1. NPD Ltd should strengthen the management of paper-based information systems by ensuring that all physical project records are properly drafted, signed, filed, and preserved.
2. NPD Ltd should invest more in computer-based project management tools such as scheduling software, automated data validation systems, and analytical dashboards. These tools should be standardized across projects to improve coordination, reporting accuracy, and timely decision-making.
3. Project managers at NPD Ltd should ensure that milestone alerts are actively used to monitor planned activities and deadlines.
4. NPD Ltd should strengthen internet-based information systems by improving cloud-based storage, collaborative platforms, and interactive communication channels.
5. Management should provide continuous PMIS training for employees involved in construction projects. Training should focus on digital documentation, dashboard interpretation, cloud security, online collaboration, and practical use of project management software.

References

- Adebayo, A. (2021). Impact of paper-based record systems on construction project performance in Nigeria. *American Journal of Civil Engineering*, 9(2), 45–53.
- Adebayo, T. (2022). Adoption of digital project information systems in African construction firms. *African Journal of Built Environment*, 14(3), 45–58.
- Chowdhury, A. (2021). Web-based technology platforms for construction project collaboration: A systematic review. *ITcon*, 26, 918–940.
- Connell, J., & Kubisch, A. (1998). *Applying a theory of change approach to evaluation*. Aspen Institute.
- Egbebi, O. (2023). Investigate the efficiency of project management software in construction projects. *International Journal of Construction Management*.
- Habimana, C. (2023). Effect of automated project task scheduling on performance of construction projects in Rwanda. *Strategic Journal of Business & Change Management*, 10(2), 55–68.
- Mwangi, S. (2024). Project information platforms and stakeholder coordination in Kenyan construction projects. *Journal of Building and Construction*, 12(4), 88–101.
- cle 3224.
- Nkurunziza, L. (2024). Organizational readiness and adoption of digital project information systems in Rwanda. *Rwanda Journal of Engineering, Science, Technology and Environment*, 7(1), 41–53.
- Okeke, C. (2021). Cloud-based platforms and construction project performance in East Africa. *American Journal of Civil Engineering*, 9(3), 67–75.
- Pasmore, W. (1988). *Designing effective organizations: The socio-technical systems perspective*. Wiley.
- Rindfleisch, A. (2019). Transaction cost theory: Past, present and future. *Academy of Marketing Science Review*, 9(3), 131–151.
- Silva, R. (2022). Digital coordination systems and workflow management in Brazilian construction
- Habimana, J. (2023). Digital documentation practices and performance of road construction projects in Rwanda. *East African Journal of Engineering*, 5(1), 22–34.
- Ibrahim, M., Zayed, T., & Lafhaj, Z. (2024). Performance measurement systems in construction projects: A critical review. *Buildings*, 14(7), Article 1988.
- Libecap, G. D. (2022). *Williamson and Coase: Transaction costs or rent-seeking in the formation of institutions*. Harvard Law School Forum on Corporate Governance.
- Mukamana, G. (2022). *Project information systems and performance of building construction projects in Kigali City* [Master's thesis, University of Rwanda].
- Mukeshu, J. (2021). *Impact of project procurement systems on performance of Rwandan building construction projects* [Master's thesis, University of Rwanda].
- Ndlovu, T. (2024). Diffusion of ERP in the construction industry: Effects on project performance. *Buildings*, 14(10), Article 1824.
- firms. *Brazilian Journal of Construction Management*, 18(2), 102–118.
- Trist, E., & Bamforth, K. (1951). Some social and psychological consequences of the longwall method of coal-getting. *Human Relations*, 4(1), 3–38.
- Uwamahoro, A. (2025). *Use of project information systems and performance of public infrastructure projects in Rwanda* [Master's thesis, University of Kigali].
- Uwimana, P. (2023). Cloud-based management practices and performance of IT projects in Rwanda: A case study of the Rwanda Digital Acceleration Project. *Global Scientific Journal*, 11(9), 122–134.
- Weiss, C. (1995). Nothing as practical as good theory: Exploring theory-based evaluation. *Evaluation*, 1(1), 65–92.

