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Effect of Project Cost Management Practices on the Performance of Construction Projects in Kigali City, Rwanda: A Case Study of Nyarutarama Property Developers (NPD) Ltd

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Abstract: *This study examined the effect of project cost management practices on the performance of construction projects in Kigali City, Rwanda, using Nyarutarama Property Developers (NPD) Ltd as a case. Rwandan construction projects frequently close over budget, behind schedule, or below the specified quality standard, and the study established how far cost benefits management, cost management strategies, and cost control practices explain variation in project performance. A mixed-method correlational design was used. From 335 project staff, a proportionate stratified sample of 182 was drawn using the Slovin formula. Data from a semi-structured questionnaire, key-informant interviews, and documentary review were analysed in SPSS version 25.0 using descriptive statistics, Pearson correlation, and multiple linear regression. All questionnaires were returned (100 per cent response rate) and Cronbach's alpha exceeded 0.7. Every construct recorded a very high mean: cost benefits management 4.59, cost management strategies 4.51, cost control practices 4.41, and project performance 4.63. Each predictor correlated significantly with performance ($r = 0.901$, 0.790, and 0.860 respectively, $p < 0.01$). The regression model was significant ($F = 267.307$, $p < 0.001$) and explained 81.8 per cent of the variance in performance ($R^2 = 0.818$). Only cost benefits management was a positive significant predictor ($\beta = 1.489$, $p < 0.001$); cost management strategies was not significant, and the negative coefficient on cost control practices reflects multicollinearity rather than a real adverse effect. The study concludes that benefits realisation is the decisive lever and recommends that firms institutionalise cost-benefit realisation frameworks and strengthen estimation capability.*

Keywords: *Project cost management; cost benefits management, Cost management strategies, Cost control practices, construction project performance, Budget adherence, Schedule adherence, Cost overrun, Nyarutarama Property Developers (NPD) Ltd, Kigali City, Rwanda.*

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1. Introduction

Cost management is central to success in the construction sector, where project environments are complex and financial exposure is high. Where costs are managed well, projects are delivered within the approved budget without compromising the agreed performance standards; where they are managed poorly, project failure is the common outcome (Wasiams & Senaratne, 2022). The three processes that sit at the core of the discipline, namely cost benefit management, strategic cost planning, and disciplined cost control, are what keep projects on schedule, on budget, and at the expected quality (Lee et al., 2021).

In developed economies the case for integrating cost management with project performance has attracted sustained academic and professional attention, driven by expectations of efficiency and accountability and by the

scale of the finances involved (Smith & Jones, 2022; Davis & Patel, 2023). Germany illustrates the adoption of sophisticated cost management systems, though difficulties remain in keeping those systems aligned with changing project requirements and evolving technology (Klein et al., 2023). In Japan, technological advancement and a stringent regulatory framework have made optimised cost management still more important for delivery within prescribed budgets and timelines (Yamamoto et al., 2023), yet synchronising cost management with dynamic project environments remains a source of performance gaps (Tanaka & Sato, 2024). Cost overruns and delays therefore persist even in mature economies (Johnson et al., 2022).

At the African level, inadequate cost management has repeatedly translated into delays, budget overruns, and compromised quality (Mabogunje et al., 2023). Techniques such as activity-based costing, risk-based budgeting, and value engineering are instrumental to project success, but their application across developing countries is inconsistent (Chirwa & Moyo, 2024), and cost control is frequently constrained by shortages of expertise and weak stakeholder participation (Ogunbiyi et al., 2022). Nigeria demonstrates how resource inadequacy and management inefficiency combine to produce overruns, poor time management, and quality problems (Ogunlana et al., 2022; Akinci et al., 2021). Tunisia presents a similar pattern of modest cost management practice constrained by structural limitations (Youssef & Abidi, 2021).

Within East Africa, Kenya's construction industry has recorded extensive delays and overspending attributable to ineffective cost management policy (Kinyua et al., 2023), while in Tanzania the momentum of infrastructural development has outpaced understanding of how cost management practices relate to project performance (Mwakalinga et al., 2021). In Rwanda, infrastructure development is propelled by government policy and international investment channelled through the Ministry of Infrastructure, which makes sound cost management a precondition for the successful completion of projects (Ministry of Infrastructure, 2022). Nevertheless, many projects still suffer cost overruns, delay, and poor quality, outcomes that place national development objectives at risk (World Bank, 2021). Because local economic and environmental variables may moderate the effect of cost management on outcomes (Omondi et al., 2023), understanding these dynamics in the Rwandan context is critical both for improving project performance and for informing policy. This study addressed that need by empirically evaluating how specific cost management practices relate to project performance in Kigali City.

1.1 Statement of the Problem

Inefficiency in construction project execution manifests as cost overrun, delay, and poor quality, all of which erode project efficiency (Kwak et al., 2022). Globally, the failure to control project costs is estimated to cost the world economy in the order of USD 1.3 trillion each year (World Bank, 2022), and more than 70 per cent of construction projects experience budget overruns (Ding et al., 2023; Flyvbjerg et al., 2021). Despite numerous corrective initiatives, projects continue to be executed without effective cost control, resulting in financial loss and diminished project value (Alkass et al., 2021).

The picture in East Africa is comparable or worse: studies report that more than 60 per cent of construction projects record cost variances, and that only about 55 per cent of completed projects comply with their projected budgets (Ndegwa et al., 2023). Cost management practices are themselves subject to inconsistency and contextual constraint, which weakens the value normally attributed to them (Otieno & Ayieko, 2021). Material price volatility and the absence of robust control mechanisms compound the problem (Olanrewaju & Abdul-Azeez, 2022), while weak cost-benefit analysis and poor implementation of control measures translate directly into delayed completion, reduced quality, and low client satisfaction (Zhao et al., 2023).

Evidence specific to Kigali is limited but suggestive. Mukiza et al. (2023), surveying 50 construction firms in Kigali City including NPD Ltd, reported a significant positive correlation ($r = 0.68$, $p < 0.01$) between rigorous cost control measures and overall project performance, and concluded that effective cost management practices are critical determinants of successful delivery in the Rwandan construction sector. What remained unresolved was the relative contribution of the distinct dimensions of cost management within a single firm, and whether the strong bivariate associations reported in the literature survive multivariate testing. This study addressed that gap.

1.2 Objectives of the Study

1.2.1 General objective

To examine the effect of project cost management practices on the performance of construction projects in Kigali City, Rwanda, with reference to NPD Ltd.

1.2.2 Specific objectives

1. To determine the effect of cost benefits management on the performance of construction projects in Kigali City.
2. To determine the effect of cost management strategies on the performance of construction projects in Kigali City.
3. To analyse the effect of cost control practices on the performance of construction projects in Kigali City.

1.3 Research Hypotheses

The three specific objectives were translated into three testable hypotheses. Consistent with the convention in

construction cost management research, each hypothesis was stated in the null form, that is, as an assertion that the dimension of cost management concerned has no significant effect on project performance. Stating the hypotheses in this form allows the effect of each construct to be assessed independently of the others while holding the remaining predictors constant in the multivariate model. Each null hypothesis was tested at the 5 per cent level of significance using the t-statistic associated with its regression coefficient, and a null hypothesis was rejected where the associated p-value fell below 0.05. The three hypotheses were as follows.

i. **H_{01}:** There is no significant effect of cost benefits management on the performance of construction projects in Kigali City.

ii. **H_{02}:** There is no significant effect of cost management strategies on the performance of construction projects in Kigali City.

iii. **H_{03}:** There is no significant effect of cost control practices on the performance of construction projects in Kigali City.

2. Literature Review

2.1 Conceptual Review

2.1.1 Cost benefits management

Cost benefits management (CBM) is the process of identifying, measuring, and realising benefits relative to cost across the project lifecycle. It is now widely recognised in the international construction sector as a determinant of project outcomes, largely because it aligns project objectives with organisational strategy and strengthens transparency and accountability (Khan et al., 2021). Contemporary construction economics treats CBM as a safeguard against cost overrun and benefit erosion (Li & Wang, 2023). Advanced analytical tools and digital technologies have improved the precision of benefit-cost estimation, helping stakeholders prioritise high-value propositions (Chen & Lee, 2024), while supply chain disruption and inflation have made CBM more urgent still (Nguyen et al., 2025). Ndegwa and Wainaina (2023) further show that structured cost-benefit analysis improves resource allocation decisions and raises the probability of successful project outcomes.

2.1.2 Cost management strategies

Cost management strategies are the methods deployed to control costs during project execution (Ogunbode & Akinola, 2022). Proactive techniques have been shown to improve overall project performance (Musa et al., 2023), reducing financial risk while supporting better decision-making, schedule management, and quality outcomes (Adebayo & Oluwatobi, 2024). Given the constraints typical of construction projects, there is a growing move toward context-specific strategies, including tailored procurement approaches and improved stakeholder cooperation (Kagendo et al., 2021). Kimani et al. (2024) and Kumar et al. (2023) similarly report that strategic cost management is most effective in urban construction settings when it is embedded in wider organisational systems rather than applied as a standalone technique.

2.1.3 Cost control practices

Cost control practices are the approaches used to regulate project costs without degrading quality (Odeh & Batta, 2022), comprising sound budgeting, disciplined change management, and financial performance evaluation (Amoako et al., 2021). In environments marked by resource constraint and rising material prices, control solutions must be adapted to conditions on the ground (Nketiah et al., 2023). Innovative techniques such as Building Information Modelling and data analytics improve cost prediction and management (Kofi et al., 2024; Ochieng & Otieno, 2022), whereas inconsistent application of control practices produces higher costs and delays (Oyedele et al., 2025).

2.1.4 Project performance

Project performance in construction is a multi-dimensional construct encompassing time, cost, quality, and stakeholder satisfaction (Olawale & Sun, 2022). Budgeting, cost control, and risk management operate as determinants of the activities that produce these outcomes (Akinci et al., 2021), and efficient cost management is consistently associated with delivery free of delay and overrun (Bertelsen & Koskela, 2023). Schedule adherence in particular has been identified as a proximate indicator of project success in urban construction (Kumar & Singh, 2023), while client satisfaction has been shown to track delivery performance closely in Kigali's urban infrastructure sector (Kamanzi & Nsengiyumva, 2025). Integrating cost management models improves performance measures particularly where resources are scarce (Mugabi & Mwesigye, 2022).

2.2 Theoretical Review

2.2.1 Cost Estimate Theory

Rooted in project management and cost accounting and associated principally with Harold Kerzner, Cost Estimate Theory holds that project scope should be decomposed into manageable components through a Work Breakdown Structure, which then forms the basis for estimating direct costs (labour, materials, equipment) and indirect costs (overheads, contingencies). It emphasises historical data, expert judgment, parametric models, iterative refinement of estimates, and the integration of risk analysis (Kerzner, 2017). Its strengths lie in the accuracy and transparency it brings to cost prediction, the early identification of cost drivers, and the improved stakeholder communication that follows. Its weaknesses are a dependence on historical data and expert judgment that may not transfer to novel projects,

the time and resource intensity of the process, and the erosion of estimate accuracy as scope changes accumulate. These limitations can be mitigated by adaptive estimation, Building Information Modelling and real-time analytics, proactive risk management, and capacity building. The theory grounds this study's treatment of estimation rigour as an antecedent of timely completion, budget adherence, and stakeholder satisfaction.

2.2.2 Resource-Based View

The Resource-Based View (RBV), developed by Wernerfelt (1984) and formalised by Barney (1991), treats an organisation's unique resources and capabilities, those that are valuable, rare, inimitable, and non-substitutable, as the primary determinants of competitive advantage and performance. Applied to construction, it directs attention to skilled personnel, technological capability, project management practice, and organisational culture as the internal assets that drive superior project outcomes. Its strength is that it foregrounds internal capabilities often under-exploited in project management and offers a strategic lens for developing them (Peteraf, 1993). Its principal weakness is relative inattention to external factors such as market dynamics, regulatory change, and stakeholder influence, together with a descriptive rather than prescriptive orientation. Combining RBV with dynamic capabilities thinking addresses this. For the present study, RBV frames cost management capability itself as a strategic resource: firms that develop superior cost management systems are better placed to control costs, optimise resource use, and achieve project success.

2.2.3 Project Management Theory

The Project Management Body of Knowledge consolidates the processes and knowledge areas required for effective project management, including the planning, estimating, budgeting, financing, funding, managing, and controlling of costs so that objectives are met within the approved budget (Project Management Institute, 2017). Its core tenets are systematic planning, disciplined execution, and continuous monitoring, integrated within the wider project management framework (Kerzner, 2017). The framework's strengths are its comprehensiveness, standardisation, and cross-industry applicability. Its weaknesses are a rigidity that can impede adaptation in dynamic construction environments, an assumption of project management maturity and resource availability that may not hold in developing contexts, and a tendency toward documentation overhead (Turner & Müller, 2005). Adapting the framework by streamlining documentation, building team capacity, and importing agile or lean elements (Highsmith, 2002) preserves rigour while improving responsiveness. The framework provides this study with its operational definition of structured cost management practice.

2.3 Empirical Review

2.3.1 Cost benefits management and project performance

Zhang et al. (2023) examined 150 Chinese construction projects using a cross-sectional survey of project managers and financial controllers analysed by multiple regression, and found cost-benefit management to be directly associated with performance in time, quality, and budget terms; the study is limited by self-report bias and geographical confinement. Kato et al. (2024) tested organisational capacity as a moderator in Uganda, combining 200 structured questionnaires with 30 semi-structured interviews across 20 large infrastructure projects, and using structural equation modelling alongside thematic analysis; they found that resource endowment, staff expertise, and organisational support significantly moderate the effect of CBM, with high-capacity organisations recording better outcomes. Kumar and Singh (2024) examined project complexity as a moderator across 200 projects in India, Australia, and South Africa using structural equation modelling and interviews. Lopez and Chen (2025) systematically reviewed 30 studies globally and found consistent links between cost-benefit analysis and cost, schedule, and quality outcomes, while criticising the literature for neglecting sustainability and for the absence of longitudinal designs capable of establishing causality.

2.3.2 Cost management strategies and project performance

Mwangi and Otieno (2023) surveyed 50 construction projects in Nairobi and, using descriptive statistics, correlation, and regression in SPSS, established a significant positive correlation between cost control techniques and project performance; the study is geographically confined and reliant on self-reported data. Nkosi and Moyo (2023) reached similar conclusions in urban South Africa, finding that proactive budgeting and financial control reduce delays and overruns, though their focus on urban mega-projects limits transferability to rural or small-scale work. Kipkemei and Kipkemei (2023) likewise found strategic cost management to be positively associated with construction project success in Kenya. Abebe and Tekle (2024) found in Ethiopia that accurate cost estimation and effective change management are critical success factors, and criticised the prevailing reactive approach to cost management. Osei and Adjei (2025) used Pearson correlation and structural equation modelling in Ghana to show that cost planning and risk management significantly predict on-time delivery, while noting that external influences such as political stability were not modelled.

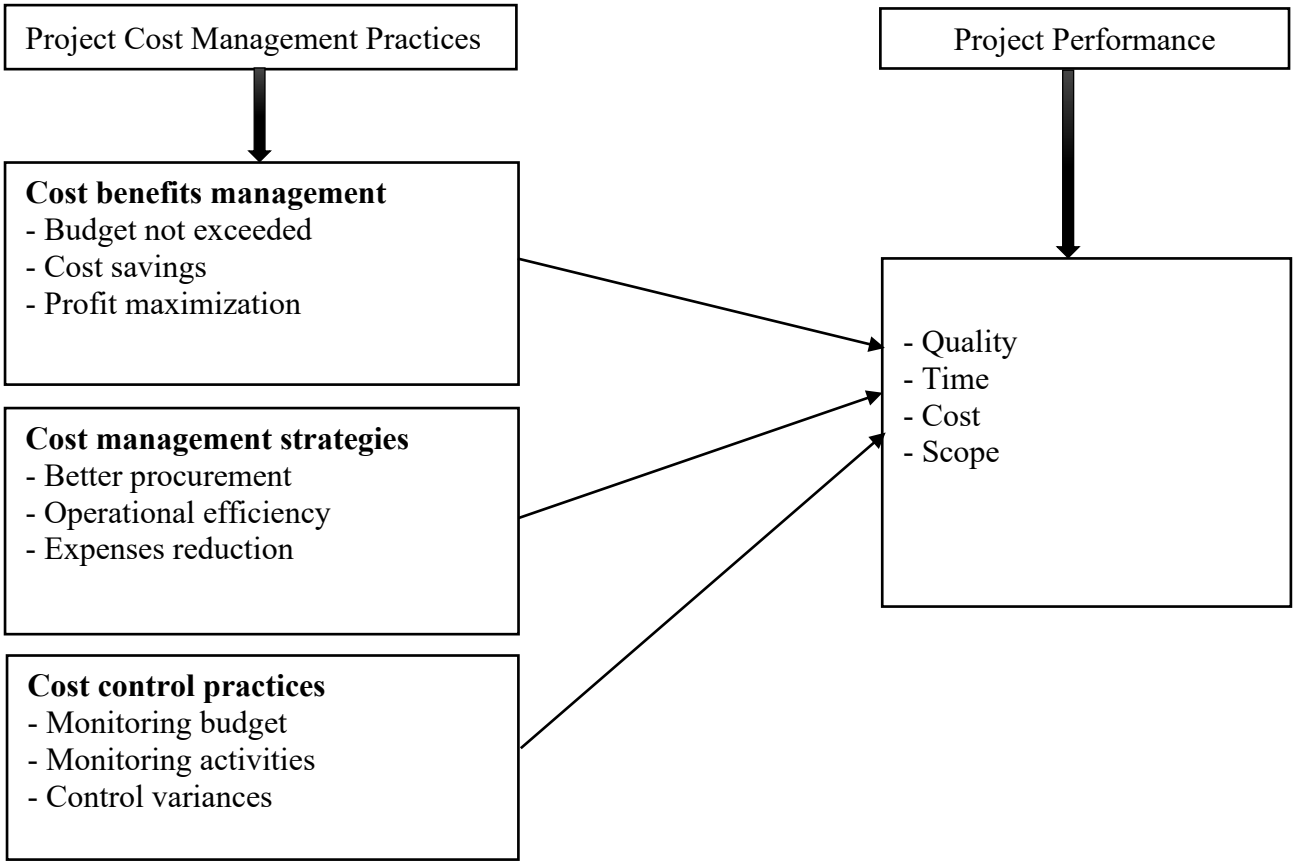
2.3.3 Cost control practices and project performance

Ivanov and Petrova (2023) surveyed 150 project managers and financial controllers across 50 Russian projects and found a strong positive correlation between

stringent cost control procedures and successful completion, in an economy where inflation and exchange rate volatility raise the stakes. Sokolova and Kuznetsova (2024) applied a sequential explanatory design with structural equation modelling to 200 Russian construction professionals and found that contingency planning, forecasting accuracy, and change management procedures reduce delay and overrun, particularly when supported by real-time data analysis. Within East Africa, Njeri and Mwangi (2024) reported that disciplined cost control practices materially improve project delivery, and Mwangi and Njuguna (2022) linked sound financial management to stronger performance in the construction sector. Most directly relevant, Ngabo et al. (2023) studied Rwandan public and private construction projects implemented between 2018 and 2022, sampling 150 project managers, engineers, and finance controllers through stratified random sampling. Using descriptive statistics, Pearson correlation, and multiple regression, they found a significant positive association between budgeting precision, cost monitoring, and change management on the one hand and performance outcomes on the other, with cost control processes accounting for approximately 65 per cent of the variance in project performance.

2.4 Conceptual Framework

The framework models project cost management practices as the independent variable, disaggregated into three constructs, namely cost benefits management, cost management strategies, and cost control practices, and construction project performance, measured through budget adherence, schedule adherence, quality conformance, and stakeholder satisfaction, as the dependent variable.



Source: Adapted from the dissertation, Figure 2.1 (Researcher, 2026).

2.5 Research Gap

Four limitations recur across the reviewed literature. First, methodological: most studies rely on self-reported data from project participants without triangulation or longitudinal follow-up, a weakness visible in Zhang et al. (2023) and Nkosi and Moyo (2023). Second, contextual: findings are typically confined to a single country or economy, whether China, Kenya, Ethiopia, or Russia, and to a single project type, and they concentrate on large infrastructure and urban projects, as in Kato et al. (2024) and Ivanov and Petrova (2023), while small, informal, and rural projects, which constitute a substantial share of construction activity in developing countries, go unexamined. Third, thematic: although cost management is repeatedly linked to sustainability, work on the innovation tools that would deliver it is thin, and Lopez and Chen (2025) call specifically for models incorporating environmental and social alongside financial benefit. Fourth, causal: the scarcity of

longitudinal designs makes causal inference difficult, and the omission of variables such as political stability and market volatility risks overstating the role of internal management systems (Osei & Adjei, 2025). The present study responds to the contextual and dimensional gaps by testing all three cost management constructs simultaneously within one Rwandan firm.

3. Methodology

3.1 Research Design

The study adopted a mixed-method research design combining quantitative and qualitative approaches, on the reasoning that the combination allows the researcher to address both the "what" and the "why" of the research question (Hancock et al., 2021). The quantitative component used closed-ended items to establish the direction and magnitude of the relationship between the cost management constructs and project performance; the qualitative component used open-ended questions and interviews to capture participants' experience and to contextualise the statistical results. A correlational orientation was used to establish how the specified indicators of cost management relate to performance outcomes.

3.2 Study Population

The target population comprised the 335 project staff of NPD Ltd working on the company's construction projects in Kicukiro District, drawn from the management, project management, technical, and engineering cadres. NPD Ltd was selected purposively on the strength of its established position in the Kigali construction market.

3.3 Sample Size and Sampling Technique

Sample size was determined using the Slovin (1960) formula at a 95 per cent confidence level with a margin of error of 0.05:

$$n = N / [1 + N(e^2)] = 335 / [1 + 335(0.05^2)] \approx 182$$

The resulting sample of 182 was then distributed proportionally across the four departmental strata using $n_i = (N_i / N) \times n$. Within each stratum, respondents were selected by simple random sampling so that every member of the stratum had an equal probability of inclusion, which strengthens the representativeness and reliability of the results.

3.4 Data Collection Instruments and Procedure

The researcher first obtained a letter of authorisation from the Dean of the Graduate School at the University of Kigali, which was used to secure a permission letter from the Head of Human Resources and Administration at NPD Ltd. Only after both consents were in place were respondents approached.

Primary data were gathered through two instruments. The questionnaire was semi-structured, permitting both statistical and thematic analysis of responses, and covered respondent background together with items on each of the four constructs measured on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Interviews were conducted using an interview guide, allowing key informants to elaborate on the mechanisms behind the survey responses. Secondary data were obtained through documentary review of textbooks, scholarly articles, and institutional records, assessed systematically for relevance, reliability, and quality (Smith & Johnson, 2021; Lee et al., 2022).

3.5 Data Processing and Analysis

Returned questionnaires were edited to confirm completeness and internal consistency, coded into numerical form to permit handling and measurement, and tabulated to allow frequencies to be compared across response categories (Dehalwar & Sharma, 2023; Mthuli et al., 2022). Data were then entered into SPSS version 25.0.

Descriptive analysis used percentages, frequency tables, means, and standard deviations. Inferential analysis used Pearson correlation and multiple linear regression to establish the magnitude and direction of the relationships between the independent variables and the dependent variable. The regression model specified was:

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

where Y is project performance; β_0 is the constant; β_1, β_2 and β_3 are regression coefficients; X_1 is cost benefits management; X_2 is cost management strategies; X_3 is cost control practices; and ε is the error term.

Mean scores were interpreted against a fixed scale: 1.00–1.80 very low; 1.81–2.60 low; 2.61–3.40 moderate; 3.41–4.20 high; and 4.21–5.00 very high. A standard deviation above 0.5 was read as indicating heterogeneous responses, and 0.5 or below as homogeneous.

3.6 Pilot Study, Validity and Reliability

A pilot study was conducted on 10 per cent of the sample to test the data collection instruments before full administration. Content validity was used to construct the questionnaire, with items derived from the reviewed literature and aligned to the theoretical constructs, ensuring that the instrument measured what it was intended to measure (Sekaran & Bougie, 2019; Bolarinwa, 2019). Reliability was assessed through internal consistency using Cronbach's alpha (Privitera & Ahlgrim-Delzell, 2018); the pilot returned an alpha above 0.7, which falls within the acceptable band and cleared the instrument for use. The interpretation scale applied is shown in Table 1.

Table 1: Interpretation scale for Cronbach's alpha coefficients

Cronbach's alpha score	Level of reliability
0.90 – 1.00	Excellent
0.80 – 0.89	Good
0.70 – 0.79	Acceptable
0.60 – 0.69	Questionable
Below 0.60	Poor

Source: Adapted from Privitera and Ahlgrim-Delzell (2018).

3.7 Ethical Considerations

The study was conducted in full compliance with the ethical norms governing research at the University of Kigali, and ethical protection was treated as a condition of data collection rather than an administrative formality. Before fieldwork commenced, the researcher submitted a comprehensive research proposal setting out the study's goals, research methods, and the ethical protections to be applied during the investigation. A letter of recommendation was obtained from the University of Kigali authorising the researcher to collect data as a graduate student of the institution, and formal clearance was separately obtained from NPD Ltd through its Head of Human Resources and Administration. Participation was voluntary and based on informed consent, respondents were free to withdraw at any stage without penalty, and no personally identifying information was recorded on the instruments. Responses were treated as confidential, reported only in aggregate form, and stored securely for the duration of the study. Sources consulted in the literature were acknowledged in full to avoid plagiarism, and the findings are reported as obtained, without alteration or selective omission.

4. Results and Discussion

4.1 Response Rate

All 182 questionnaires distributed were completed and returned with no missing responses, giving a response rate of 100 per cent. A response rate of this level removes non-response bias as a threat to validity and is attributable to the institutional clearance secured before fieldwork and to on-site administration of the instrument. Analysis proceeded in three stages: descriptive results for each construct, correlation analysis, and multivariate regression with hypothesis testing.

4.2 Descriptive Results

Table 2 summarises the composite mean scores for the three independent constructs and for the dependent variable, interpreted against the scale set out in Section 3.5.

Table 2: Composite descriptive statistics for the study constructs (n = 182)

Construct	Mean	Interpretation
Cost benefits management	4.59	Very high
Cost management strategies	4.51	Very high
Cost control practices	4.41	Very high
Project performance	4.63	Very high

Source: Primary data (2026). Means interpreted on a five-point Likert scale where 4.21–5.00 denotes a very high level of agreement.

All four constructs fall within the very high band, indicating that respondents perceive cost management practices at NPD Ltd to be well established and project performance to be strong. The uniformity of these scores is itself informative: it points to a firm in which cost management is embedded as routine practice rather than applied selectively, which is consistent with the position Mukiza et al. (2023) report for the better-performing firms in their Kigali sample.

Beneath the composite scores, however, the item-level results are uneven. The accuracy of cost estimation returned the lowest mean in the study at 3.9945, falling into the high rather than very high band, and recorded the widest dispersion of any item. Daily cost monitoring (4.1044) and change control (4.1813) likewise scored lower and more heterogeneously than the delivery outcomes they are credited with producing. The pattern indicates that the control machinery is less consistently

applied across projects than the aggregate score suggests, a finding that mirrors the observation of Abebe and Tekle (2024) that accurate estimation and effective change management remain the weakest links in cost management practice in East African construction, and that of Otieno and Ayieko (2021) that cost management practices in the region are subject to inconsistency and contextual constraint.

4.3 Correlation Analysis

Table 3: Pearson correlation matrix for the study variables (n = 182)

Variable	CBM	CMS	CCP	Performance
Cost benefits management (CBM)	1	.891**	.974**	.901**
Cost management strategies (CMS)	.891**	1	.865**	.790**
Cost control practices (CCP)	.974**	.865**	1	.860**
Project performance	.901**	.790**	.860**	1

*Source: Primary data (2026). ** Correlation is significant at the 0.01 level (two-tailed).*

All three independent variables correlate strongly and significantly with project performance. Cost benefits management shows the strongest association ($r = 0.901$), followed by cost control practices ($r = 0.860$) and cost management strategies ($r = 0.790$), all significant at $p < 0.01$. On the conventional interpretation, coefficients between 0.5 and 1.0 denote a strong positive relationship, so all three fall comfortably in that range. These bivariate results align closely with the wider literature: Zhang et al. (2023) reported a direct association between cost-benefit management and performance across 150 Chinese projects, Ivanov and Petrova (2023) found a strong positive correlation between stringent cost control and successful completion in Russia, and Mwangi and Otieno (2023) established a significant positive correlation between cost control techniques and performance in Nairobi. The magnitude observed here ($r = 0.901$ for CBM) is higher than the $r = 0.68$ reported by Mukiza et al. (2023) across 50 Kigali firms, which is consistent with a single-firm design in which cost management practice is uniform rather than varying across organisations.

A feature of the matrix that carries directly into the regression results is the strength of the inter-correlations among the predictors themselves. Cost benefits management and cost control practices correlate at $r = 0.974$, cost benefits management and cost management strategies at $r = 0.891$, and cost management strategies and cost control practices at $r = 0.865$. Predictors this closely related overlap substantially in the variance they explain, which has consequences for the stability and interpretation of the individual coefficients in the multivariate model that follows.

4.4 Regression Analysis

Table 4: Model summary

Model	R	R^2	Adjusted R^2	Std. error of the estimate
1	.905[a]	.818	.815	1.61865

Source: Primary data (2026). [a] Predictors: (constant), cost control practices, cost management strategies, cost benefits management.

The model returns $R = 0.905$ and $R^2 = 0.818$, meaning that 81.8 per cent of the variation in construction project performance is explained jointly by the three cost management constructs. The adjusted R^2 of 0.815 confirms that the explanatory power is not an artefact of the number of predictors. The remaining 18.2 per cent is attributable to variables outside the model, plausibly including the external factors that Osei and Adjei (2025) identify as unmodelled in most cost management studies, such as political stability and market volatility, and the moderating role of organisational capacity documented by Kato et al. (2024). The explanatory power reported here exceeds the approximately 65 per cent of variance that Ngabo et al. (2023) attributed to cost control processes in Rwandan construction projects, which is expected given that the present model specifies three cost management dimensions rather than one.

Table 5: Analysis of variance for the regression model

Model	Sum of squares	df	Mean square	F	Sig.
Regression	2101.049	3	700.350	267.307	.000[b]
Residual	466.363	178	2.620		
Total	2567.412	181			

Source: Primary data (2026). Dependent variable: project performance. [b] Predictors: (constant), cost control practices, cost management strategies, cost benefits management.

The F-statistic of 267.307 with $p < 0.001$ confirms that the model as a whole is statistically significant and fit for predicting project performance from the three independent variables.

Table 6: Regression coefficients

Model	B	Std. error	Beta	t	Sig.
(Constant)	1.126	1.672	—	.674	.501
Cost benefits management	1.489	.179	1.293	8.327	.000
Cost management strategies	−.076	.081	−.066	−.936	.351
Cost control practices	−.309	.127	−.342	−2.436	.016

Source: Primary data (2026). Dependent variable: project performance.

Cost benefits management is a positive and highly significant predictor: each unit increase is associated with a 1.489 unit increase in project performance ($t = 8.327$, $p < 0.001$). Cost management strategies is not statistically significant ($p = 0.351$), and its coefficient is close to zero. Cost control practices is statistically significant at the 5 per cent level ($p = 0.016$) but carries a negative coefficient of −0.309.

The negative sign on cost control practices requires interpretation, since the bivariate correlation for the same variable was strongly positive ($r = 0.860$). Two readings are available. The first, suggested by the wider control literature, is that excessive control activity may become counterproductive: beyond a threshold, monitoring and change-control procedures consume management attention and slow decision-making rather than improving outturn, an effect consistent with the documentation overhead that Turner and Müller (2005) identify as a weakness of highly proceduralised project management frameworks. The second reading, and the more probable statistically, is multicollinearity. At $r = 0.974$ with cost benefits management, cost control practices shares almost all of its variance with another predictor, and in that situation individual coefficients become unstable and can flip sign without indicating any real negative effect. Given that Ngabo et al. (2023), Njeri and Mwangi (2024), and Mugisha et al. (2022) all report positive associations between cost control practices and performance in Rwandan and East African settings, the multicollinearity explanation is the more defensible.

4.5 Hypothesis Testing

Hypotheses were tested using the t-statistic to determine whether the B values differed significantly from zero, with the null rejected where $p < 0.05$. Table 7 summarises the outcome.

Table 7: Summary of hypothesis testing

Null hypothesis	Coefficient (t; p)	Decision	Effect
H_{01}: No significant effect of cost benefits management	$\beta = 1.489$ ($t = 8.327$; $p = .000$)	Rejected	Significant, positive
H_{02}: No significant effect of cost management strategies	$\beta = -.076$ ($t = -.936$; $p = .351$)	Retained	Not significant
H_{03}: No significant effect of cost control practices	$\beta = -.309$ ($t = -2.436$; $p = .016$)	Rejected	Significant

Source. Derived from Table 6.

The first null hypothesis was rejected: cost benefits management has a statistically significant positive effect on the performance of construction projects in Kigali City. The second null hypothesis was retained: at $p = 0.351$ the effect of cost management strategies on project performance is not statistically significant in the

multivariate model, notwithstanding its strong bivariate correlation. The third null hypothesis was rejected: cost control practices has a statistically significant effect at p = 0.016, though as noted the sign of the coefficient in the multivariate model warrants cautious interpretation.

4.6 Discussion of Findings

Taken together, the results locate this study firmly within, and in one respect against, the existing evidence base. The finding that cost benefits management is the dominant predictor of project performance supports Khan et al. (2021), who argue that benefits realisation improves outcomes by aligning project objectives with organisational strategy and strengthening accountability, and Zhang et al. (2023), whose Chinese evidence links cost-benefit management directly to time, quality, and budget performance. It is also consistent with the global systematic review by Lopez and Chen (2025), which found stable links between cost-benefit analysis and cost, schedule, and quality outcomes across 30 studies, and with Ndegwa and Wainaina (2023), who attribute improved resource allocation and higher success rates to structured cost-benefit analysis. The present study extends this work by showing that, when the three cost management dimensions are tested simultaneously rather than in isolation, benefits management retains its explanatory power while the other two do not.

The non-significance of cost management strategies is the point at which this study diverges from the literature. Mwangi and Otieno (2023) in Nairobi, Nkosi and Moyo (2023) in South Africa, Kipkemei and Kipkemei (2023) in Kenya, and Kimani et al. (2024) and Kumar et al. (2023) in urban settings more generally all report significant positive effects of strategic cost management on performance. The divergence is best explained by design rather than substance. Those studies test strategy either bivariately or across multiple firms, where variation in strategic practice between organisations generates the variance a regression requires. The present study tests three highly inter-correlated constructs within a single firm, where strategic cost planning is not an independent lever but is operationalised through the benefits-management and control mechanisms already in the model. Read alongside the strong bivariate correlation of r = 0.790, the result indicates redundancy in the multivariate specification, not irrelevance in practice.

On cost control practices, the strong positive correlation replicates Ivanov and Petrova (2023), Sokolova and Kuznetsova (2024), Njeri and Mwangi (2024), and, closest to the present context, Ngabo et al. (2023) and Mugisha et al. (2022) in Rwanda. The negative multivariate coefficient should not be read as contradicting them, for the reasons set out in Section 4.4. What the item-level descriptive evidence does add is a qualification these studies do not capture: control practice at NPD Ltd is unevenly applied, with estimation accuracy and daily monitoring the weakest components, echoing the concerns of Abebe and Tekle (2024) about reactive rather than anticipatory cost management, and pointing toward the data-driven and Building Information Modelling approaches advocated by Ochieng and Otieno (2022) and Kofi et al. (2024) as the practical remedy. Finally, the very high project performance mean of 4.63, spanning budget adherence, schedule adherence, quality, and stakeholder satisfaction, is consistent with Kumar and Singh (2023) on schedule adherence as a proximate marker of success and with Kamanzi and Nsengiyumva (2025), who found client satisfaction to track delivery performance closely in Kigali's urban infrastructure sector.

4.7 Implications of the Study

For policy makers, the study supplies evidence that can inform regulation aimed at improving accountability, transparency, and efficiency in cost management, with downstream benefits for resource allocation, overrun reduction, and delivery timelines. For society, better cost management means projects delivered on time and within budget, which translates into safer and more reliable infrastructure and more efficient use of public funds. For researchers and academia, the study contributes to a thin body of Rwandan evidence on project cost management and provides a base from which related variables, including risk management, stakeholder engagement, and technological integration, can be investigated. For the University of Kigali, it adds to the institutional stock of applied project management research grounded in local practice.

5. Conclusion and Recommendations

5.1 Conclusion

The study set out to examine the effect of project cost management practices on the performance of construction projects in Kigali City through the case of NPD Ltd, testing three cost management dimensions against a single performance construct. On the evidence assembled, project cost management practices are a critical determinant of construction project performance: the three constructs jointly explain 81.8 per cent of the observed variation in project outcomes, and the model as a whole is statistically significant.

Three conclusions follow from the specific objectives. On the first objective, cost benefits management is the practice that most reliably converts cost management effort into project performance. It recorded the strongest bivariate correlation (r = 0.901) and was the only positive significant predictor in the multivariate model (β = 1.489, $p < 0.001$), so the first null hypothesis was rejected. The discipline of identifying, quantifying, and tracking value delivered against expenditure is what distinguishes effective cost management from mere cost accounting.

On the second objective, cost management strategies had no statistically significant independent effect on project performance ($\beta = -0.076$, $p = 0.351$), and the second null hypothesis was therefore retained. This should not be read as evidence that strategy is irrelevant. Given its strong bivariate correlation ($r = 0.790$) and the very high inter-correlations among the predictors, the result is better read as an indication that, at NPD Ltd, strategic cost planning operates through the benefits-management and control mechanisms rather than as an independent lever.

On the third objective, cost control practices had a statistically significant effect ($p = 0.016$) and the third null hypothesis was rejected, but the negative sign of the coefficient in the presence of a strong positive correlation ($r = 0.860$) is attributable to multicollinearity rather than to any genuine adverse effect. The descriptive evidence adds a substantive qualification: estimation accuracy (3.9945) and daily monitoring (4.1044) scored materially lower and more heterogeneously than the delivery outcomes they support, indicating that the control machinery is less consistently applied than the aggregate results suggest.

Overall, the study concludes that benefits realisation, rather than strategic planning or control intensity taken alone, is the decisive lever through which cost management improves construction project performance in the Kigali context, and that the practical constraint on further improvement lies in the consistency with which estimation and monitoring are applied.

5.2 Recommendations

Based on the findings of the study, the following recommendations are made to enhance cost management practices and improve the performance of construction projects in the City of Kigali. The first four are directed at NPD Ltd and comparable construction firms, and the remaining three at the Ministry of Infrastructure and sector regulators.

1. NPD Ltd should prioritise cost benefits management. Given its beta coefficient of 1.489 and correlation of 0.901 with performance, the company should institutionalise formal cost-benefit realisation frameworks that identify, quantify, and track benefits against expenditure across the full project lifecycle rather than at appraisal alone. Benefit owners should be named at project inception and required to report realisation at each gate review.
2. NPD Ltd should strengthen cost estimation capability. Accurate cost estimation returned the lowest score in the study (3.9945) with the widest dispersion, making it the clearest single improvement target. The company should invest in estimator training, structured use of historical cost databases, and parametric estimating models, and should benchmark estimates against completed project outturns.
3. NPD Ltd should tighten and standardise daily cost monitoring and change control. Scores of 4.1044 and 4.1813 respectively, both with high dispersion, indicate inconsistent application across projects. Standardised monitoring protocols, a uniform change control procedure, and real-time reporting supported by data analytics would reduce that variance.
4. NPD Ltd should audit cost management strategies that are not producing measurable gains. The absence of a significant independent effect ($\beta = -0.076$, $p = 0.351$) is a signal to review existing strategic cost methodologies, retain those demonstrably linked to outcomes, and discontinue those that generate process without result, so that management attention is redirected to benefits realisation.
5. The Ministry of Infrastructure should strengthen the regulatory framework for cost management. Policies and regulations governing cost management in the construction industry should be refined so that minimum standards for estimation, monitoring, and variance reporting apply consistently across firms, and so that compliance is verifiable at project close-out.
6. The Ministry of Infrastructure should support capacity building in project cost management. Professional certification pathways and structured industry training would address the expertise constraint identified across the East African literature and observed in the estimation scores reported here.
7. A national or sectoral cost database should be established. Such a database would give firms a basis for benchmarking and parametric estimation, directly targeting the estimation accuracy gap identified as the weakest element of current practice.

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