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Risk Management Strategies and Performance of Ultimate Developers Limited Commercial Construction Projects of RSSB Rwanda

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Abstract: *Despite the growth of Rwanda's construction sector, commercial building projects had continued to experience cost overruns, schedule delays, and quality deficiencies, partly reflecting weaknesses in systematic risk management practices. This study examined the influence of risk management strategies on performance of Ultimate Developers Limited commercial construction projects of Rwanda Social Security Board (RSSB), Rwanda. It assessed risk identification, risk assessment and analysis, risk response planning, and risk monitoring and control, guided by Enterprise Risk Management Theory, Systems Theory, and Contingency Theory. The quantitative component used structured questionnaires from 207 professionals, representing 98.1% of 211 distributed questionnaires. Pearson correlation and multiple linear regression were applied. Risk identification ($\beta = 0.295$, $p < 0.001$), risk assessment and analysis ($\beta = 0.148$, $p = 0.005$), risk response planning ($\beta = 0.305$, $p < 0.001$), and risk monitoring and control ($\beta = 0.186$, $p = 0.001$) had positive statistically significant relationships with project performance. The joint model explained 62.5% of the variation in performance ($R^2 = 0.625$). The study concluded that integrated risk management supported cost control, timely completion, and quality outcomes. It recommended institutionalizing risk registers, multidisciplinary risk reviews, risk-based contingency planning, and continuous monitoring and control procedures.*

Keywords: *Risk identification, risk assessment, risk response planning, risk monitoring and control, project performance.*

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1. Introduction

Performance of construction projects has remained unstable globally, particularly in terms of timely completion, cost control, quality achievement and attainment of planned project objectives, despite the continuous growth of investment in infrastructure and real-estate development. Construction projects are exposed to numerous uncertainties, including changes in project scope and design, inflation, material and labour shortages, financing constraints, procurement problems, regulatory requirements, contractor weaknesses, environmental hazards and stakeholder conflicts. McKinsey & Company (2023), based on an analysis of 532 major capital projects worldwide, reported that cost overruns averaged at least 79% above initial estimates, while delays averaged approximately 52% beyond planned schedules. Similarly, the Royal Institution of Chartered Surveyors (RICS, 2024) reported persistent concerns regarding construction productivity, with only 9% of respondents globally expecting construction productivity to increase over the following 12 months.

Despite the continued expansion of Rwanda's construction sector, the performance of construction projects remains a concern, particularly regarding completion within planned time, approved budgets, required quality standards and intended project objectives. The Office of the Auditor General of Rwanda (OAG, 2024) reported 23 stalled construction projects valued at Frw19.02 billion and 491 idle assets valued at Frw7.90 billion across 45 public institutions. These findings indicate that increased construction activities do not always translate into successful project delivery. At the same time, the National Institute of Statistics of Rwanda (NISR, 2025) reported a 12% growth in

construction activities in 2024, demonstrating continued sector expansion alongside persistent implementation challenges. Such delays, stalled works, cost implications and quality concerns can reduce the efficiency and value obtained from construction investments, thereby highlighting the need to strengthen risk management strategies as mechanisms for improving project performance.

At the organizational level, UDL, a subsidiary of RSSB, undertakes major property-development projects, including Vision City and other pension-related developments. The scale and value of these investments make effective project performance important for achieving planned time, cost, quality and delivery outcomes. Rwanda's NST2 (2024–2029), National Urbanisation Policy (2025), building regulations and public procurement reforms further emphasize efficient and accountable project implementation. However, the continued occurrence of stalled and delayed construction projects reported by OAG suggests that the practical challenges surrounding risk management and project performance require further investigation. Therefore, this study seeks to examine the effect of risk management strategies risk identification, risk assessment and analysis, risk response and mitigation, and risk monitoring and control on the performance of UDL commercial construction projects under RSSB, Rwanda.

1.1 General Objective

The general objective of this study was to examine the influence of risk management strategies on the performance of Ultimate Developers Limited (UDL) commercial construction projects under the Rwanda Social Security Board (RSSB) in Rwanda.

1.2 Specific Objectives

The study was guided by the following specific objectives:

1. To assess the influence of risk identification strategies on the performance of UDL commercial construction projects under RSSB in Rwanda.
2. To determine the effect of risk assessment and analysis strategies on the performance of UDL commercial construction projects under RSSB in Rwanda.
3. To examine the influence of risk response and mitigation strategies on the performance of UDL commercial construction projects under RSSB in Rwanda.
4. To analyze the effect of risk monitoring and control mechanisms on the performance of UDL commercial construction projects under RSSB in Rwanda.

2. Literature Review

This section presents the theoretical foundations and empirical literature related to the four risk management strategies and construction project performance.

2.1 Theoretical Review

This study was grounded in several theories that explain the mechanisms through which organizational risk management practices affect project performance.

2.1.1 Enterprise Risk Management (ERM) Theory

Enterprise Risk Management (ERM) Theory was institutionalized through the Committee of Sponsoring Organizations of the Treadway Commission (COSO), which issued the Enterprise Risk Management Integrated Framework in 2004and substantially updated it in 2017 as Enterprise Risk Management Integrating with Strategy and Performance. Although ERM does not have a single individual founder in the same manner as Systems Theory, COSO is the principal institutional developer of the modern ERM framework. The 2017 framework conceptualizes risk management as an integrated process through which an organization considers risk while setting strategy and pursuing performance objectives. Its central assumption is that risk should not be managed as an isolated compliance activity but should be embedded in governance, strategy formulation, performance management, and decision-making. COSO's framework emphasizes five interrelated components: governance and culture, strategy and objective-setting, performance, review and revision, and information, communication and reporting (COSO, 2017).

2.1.2 Systems Theory

Systems Theory, particularly General Systems Theory, is principally associated with Austrian biologist Ludwig von Bertalanffy, whose systematic formulation was developed during the mid-twentieth century and consolidated in General System Theory in 1968. The theory assumes that an organization is an open system composed of interconnected and interdependent elements that interact with one another and with the external environment. Von Bertalanffy (1968) argued that systems should be understood in terms of relationships among their components rather than by examining individual components in isolation. The theory therefore emphasizes concepts such as interdependence, interaction, inputs, transformation processes, outputs, feedback, boundaries, adaptation, and environmental exchange. In project management, a construction project can be conceptualized as a complex system in which human resources, financial resources, materials, equipment, technology, contracts, procurement arrangements, designs, stakeholders, regulatory requirements, and managerial processes interact continuously.

2.1.3 Contingency Theory

Contingency Theory developed from the work of organizational scholars Tom Burns and G. M. Stalker (1961) and was subsequently advanced by scholars including Paul Lawrence and Jay Lorsch (1967). The theory challenges the assumption that one universal management approach is appropriate for all organizations and situations. Its central proposition is that the effectiveness of a management practice depends on the fit between the practice and the characteristics of the

environment, organization, task, technology, and situation in which it is applied. Burns and Stalker (1961) distinguished between organizational arrangements that are more mechanistic and those that are more organic, while Lawrence and Lorsch (1967) emphasized the importance of organizational differentiation and integration in environments characterized by different levels of uncertainty. Applied to project risk management, Contingency Theory implies that risk-management strategies should be selected according to the nature, probability, magnitude, timing, and context of specific project risks. A standardized risk procedure may provide a useful baseline, but the actual response may need to differ according to project size, technical complexity, contract structure, financing arrangements, stakeholder interests, regulatory requirements, location, and environmental conditions.

2.2 Empirical Review

Research consistently demonstrates that project risk management strategies play a central role in shaping construction project performance. When organizations apply structured processes of risk identification, assessment, response planning, and monitoring, they are better positioned to deliver projects within expected cost, time, and quality standards. Although researchers approach the subject from different perspectives, there is broad agreement that comprehensive PRM enhances decision-making and supports effective project execution.

2.2.1 Risk Identification Strategies and Projects Performance

Risk identification represents the initial empirical dimension through which project management teams recognize events, conditions, assumptions, constraints, and uncertainties that may influence project objectives. Recent construction research increasingly treats identification as a proactive rather than merely administrative activity because risks that remain unidentified are unlikely to receive adequate assessment, ownership, mitigation, or monitoring. Nanette and Wabala (2026) investigated project risk management and performance in the Rwanda Urban Development Project using a descriptive and correlational research design and SPSS-based inferential analysis. Their findings showed a strong overall association between risk-management practices and project performance, with $R = 0.862$ and $R^2 = 0.742$, indicating that 74.2% of the variation in project performance was explained collectively by risk identification, risk analysis, response planning, and monitoring and control. More specifically, risk identification had a positive and statistically significant coefficient of $\beta = 0.249$, $t = 4.195$, $p = 0.000$. This result indicates that risk identification was not simply a procedural requirement but was statistically associated with higher project performance.

Similarly, Igihozo and Irechukwu (2022) examined the project risk-management process and performance of the Mpazi Channel Construction Project in Nyabugogo, Kigali, Rwanda. The researchers adopted a descriptive mixed-methods design and selected 118 respondents from a target population of 168 using stratified sampling and Slovin's formula. Data were analysed using SPSS, descriptive statistics, correlation and regression analysis. The study reported an exceptionally strong positive relationship between project risk identification and project performance, with $r = 0.970$ and $p = 0.000$, while the combined risk-management model involving risk identification, risk-management planning, and risk-response planning explained approximately 97.5% of project-performance variation ($R^2 = 0.975$).

The study concluded that formal risk-management procedures should be implemented from project planning through execution and recommended that construction personnel, support staff, and labourers should be incorporated into the process. Although the magnitude of the reported relationship is considerably stronger than that reported by Nanette and Wabala (2026), the difference may reflect the specific project setting, measurement instruments, sample characteristics, and modelling approach rather than necessarily indicating that risk identification has the same effect across all construction projects. The study is particularly useful to the present research because Mpazi Channel was a Rwandan construction project, thereby providing contextual evidence that early identification is relevant to local project performance. Nevertheless, the present research extends this evidence by examining UDL commercial projects within an RSSB investment environment and by separating risk identification from assessment, response, and monitoring.

2.2.2 Risk Assessment and Analysis Strategies and Projects Performance

Risk assessment and analysis constitute the second stage of the risk-management process because identifying a risk does not by itself indicate its importance or determine the resources required to manage it. Assessment enables project teams to establish the likelihood, potential severity, exposure, and priority of identified risks, while analysis can involve qualitative ranking, probability-impact matrices, sensitivity analysis, scenario analysis, expected monetary value, simulation, or other quantitative techniques. Nanette and Wabala (2026) provide recent Rwandan evidence demonstrating the performance implications of this process.

Their descriptive-correlational study of the Rwanda Urban Development Project reported an overall $R = 0.862$ and $R^2 = 0.742$, showing that the combined risk-management dimensions explained 74.2% of the variation in project performance. Within the model, risk analysis produced $\beta = 0.217$, $t = 2.771$, $p = 0.006$, indicating a positive and statistically significant relationship with project performance. The researchers interpreted the result as evidence that systematic risk analysis helped reduce uncertainty and recommended stronger scope-definition and risk-management procedures. The finding is important for UDL because construction projects require managers to distinguish high-impact risks from relatively minor risks so that limited managerial and financial resources can be concentrated where they matter most. The researcher therefore considers the result supportive of the second objective, although the difference between RUDP and UDL means that the

strength of the relationship must be established empirically rather than presumed.

In Kenya, Machira and Kising'u (2024) assessed risk identification and risk analysis within road construction projects in Kilifi County. Their population consisted of 224 project implementation personnel attached to 56 road projects, with 144 respondents from 36 projects selected using proportionate stratified random sampling. The study used a quantitative non-experimental correlational cross-sectional design, structured questionnaires, SPSS Version 26, Pearson correlation, and multiple regression. Both risk identification and risk analysis were found to have positive and statistically significant relationships with project performance. The authors concluded that project managers should implement structured risk-management practices and recommended policy review to promote systematic risk management.

A related study by Cherono and Nyang'au (2024) investigated risk identification and risk assessment among construction projects in Nairobi City County. The research targeted 368 construction projects and selected 192 projectsthrough simple random sampling. A descriptive research design was employed, with semi-structured questionnaires used to obtain quantitative and qualitative data, while SPSS Version 25 supported descriptive and inferential analysis. The study concluded that risk assessment had a positive and significant effect on construction-project performance, alongside risk identification. The researchers consequently recommended that project managers prioritize systematic risk-management practices rather than relying on reactive responses after problems had already occurred. The study provides a useful contrast with the Rwandan evidence because both studies examine construction projects but within different national construction environments.

2.2.3 Risk Response Planning Strategies and Projects Performance

Risk response planning represents the stage at which identified and assessed risks are converted into specific managerial actions. Responses may include risk avoidance, reduction, transfer, acceptance, contingency planning, contractual allocation, resource reallocation, alternative procurement arrangements, insurance, schedule adjustments, or technical interventions. Nanette and Wabala (2026) provide particularly relevant Rwandan evidence because their study explicitly modelled risk-response planning as one of the determinants of project performance in the Rwanda Urban Development Project. Using a descriptive and correlational research design and SPSS analysis, the researchers found that the overall risk-management model produced $R = 0.862$ and $R^2 = 0.742$. Risk-response planning had a positive and statistically significant coefficient of $\beta = 0.272$, $t = 3.151$, $p = 0.002$, indicating that an increase in risk-response planning was associated with an increase in project performance.

Sangwa and Dushimimana (2023) also provide direct evidence from Rwanda through their study of the TWICECEKA Project in Huye District. The research examined risk identification, risk analysis, risk response planning, and risk monitoring and control, using statistical analysis to establish the relationship between these dimensions and project performance. Their regression findings showed a positive and statistically significant coefficient for risk response planning of $\beta_3 = 0.425$, $p < 0.05$, leading to rejection of the null hypothesis that response planning had no significant effect on project performance. The researchers concluded that project teams needed to improve the quality of risk analysis and use the resulting information to support effective response planning.

Further evidence comes from Nkiranuye et al. (2025), who studied risk-management practices among large construction companies in Rwanda using 206 respondents, including managers, engineers, and owners. Their quantitative analysis reported a combined $R^2 = 0.706$, meaning that risk identification, planning, monitoring, and mitigation collectively explained approximately 70.6% of variation in construction-project performance. The study identified weaknesses in contingency-budget preparation, risk-response schedules, communication, and reporting. The authors observed that inadequate risk planning and mitigation contributed to cost overruns, disruptions in project communication, and delays in project implementation. They recommended that construction companies specify risk types, categories, budgets, response strategies, timelines, and responsible personnel before project execution.

2.2.4 Risk Monitoring and Control Mechanisms and Projects Performance

Risk monitoring and control constitute the continuing dimension of project risk management because construction risks can change in probability, severity, ownership, and consequences as projects move from planning to procurement and implementation. Nanette and Wabala (2026) provide recent Rwandan evidence by including monitoring and control as one of four explanatory dimensions of project risk management in the Rwanda Urban Development Project. Their descriptive-correlational research found that the combined risk-management model explained 74.2% of variation in project performance ($R^2 = 0.742$). Within the regression model, risk monitoring and control had a positive and statistically significant coefficient of $\beta = 0.204$, $t = 3.029$, $p = 0.003$. The finding suggests that monitoring and control contributed to project performance even after accounting for risk identification, analysis, and response planning.

The authors recommended stronger project-management procedures and adherence to established project requirements to prevent scope-related problems. The importance of this finding to UDL is that risk management cannot end after a response has been selected; project managers must continually establish whether the response is being implemented, whether the risk remains relevant, and whether new risks have emerged. The researcher therefore considers monitoring and control a mechanism through which UDL could have detected deviations in cost, schedule, and quality before they developed into more serious project-performance problems.

A related Kenyan study by Khisa and Mutiso (2022) examined project control risk management and performance of selected construction projects in Kenya. The study's focus on project control is particularly relevant to the present objective because risk monitoring and control require mechanisms through which planned project conditions are compared with actual performance. Construction control systems commonly involve schedule monitoring, budget monitoring, quality inspections, progress reporting, variation tracking, contractor performance reviews, and risk-register updates.

The importance of monitoring can also be seen in Nguru and Kaburu (2023), who examined risk-management practices and performance of projects in Kenya Power Limited. Their study considered risk planning, risk detection, risk analysis, and risk control and involved project-management committee members, project implementation personnel, and contractors, producing a total study population of 198 participants. The researchers used a descriptive research approach and analysed data using SPSS, presenting findings through means, frequency tables, graphs, and pie charts. The study reported that Kenya Power projects performed better when risk analysis was undertaken early, followed by risk planning and risk identification. The inclusion of risk control within the study is important because it shows that monitoring and control operate as part of a broader risk-management sequence. However, the Kenya Power context differs from UDL commercial construction because energy projects involve infrastructure, utility operations, and technical systems that may generate different risk profiles. The researcher therefore considers the study useful for demonstrating the importance of integrated risk-control processes but not as a direct substitute for evidence from property-development projects. For UDL, the central issue is whether project-monitoring information was sufficiently timely and accurate to support corrective decisions concerning cost, schedule, and quality.

3. Methodology

3.1 Research Design

The study adopted a quantitative approach for the analyses presented in this manuscript, using questionnaire responses to examine relationships among risk management practices and project performance.

3.2 Study Population and Sampling

The target population comprised of 468 construction professionals who had been involved in UDL commercial building projects under RSSB executed in years 2020 and 2026. The population consisted of individuals who had direct or substantial involvement in planning, managing, supervising, designing, contracting, consulting, or representing clients in commercial construction projects. These included project managers, site engineers, contractors or contractor representatives, architects and quantity surveyors, and client representatives.

The quantitative sample size was determined using Cochran's (1977) formula, appropriate for estimating sample sizes for large populations. The initial sample size for an infinite population was calculated as:

$$\boldsymbol{n_0 = \frac{z^2 \cdot p(1-p)}{e^2}}$$

Where:
n_o = initial sample size
Z = 1.96 (95% confidence level)
p = 0.5 (assumed population proportion)
e = 0.05 (acceptable margin of error)

$$n_0 = \frac{1.96^2 \cdot 0.5(1-0.5)}{0.05^2} = 384$$

This yields to an initial sample size of 384 respondents. Because the study population was finite (N = 468), a finite population correction was applied:

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

$$n = \frac{384}{1 + \frac{(384 - 1)}{468}} = 211.22$$

Where:
n= adjusted sample size (211)
This adjustment produced a final quantitative sample size of approximately 211 respondents. Data were successfully collected from all 211 targeted respondents

3.3 Data Collection Instrument

Structured five-point Likert-scale questionnaires were used to assess risk identification, risk assessment and analysis, risk response planning, risk monitoring and control, and project performance.

3.4 Pilot Study, Validity and Reliability

A pilot study was conducted before the main data collection to assess the suitability of the research instruments. The purpose of the pilot study was to determine whether the questionnaire and interview guide were clear, relevant, logically structured, and appropriate for the intended respondents. Pilot testing was particularly important because it enabled the researcher to identify ambiguous wording, repetitive items, inappropriate response options, or questions that respondents could interpret differently.

Content validity was established through expert review and pilot testing. The questionnaire and interview guide were reviewed by the academic supervisor and experts with knowledge of project management, construction management, and research methodology. The reviewers examined whether the items were clear, relevant, sufficiently comprehensive, and aligned with the study objectives, research questions, conceptual framework, and operational definitions.

Reliability of the quantitative questionnaire was assessed using Cronbach's alpha coefficient. Cronbach's alpha evaluates the internal consistency of items within a scale, with higher values generally indicating stronger consistency among the items measuring the same construct. Nunnally and Bernstein (1994) identified approximately 0.70 as an acceptable threshold, although

interpretation should also consider the purpose and stage of scale development.

3.5 Data Analysis

Three inferential techniques were used to test the relationships implied by the study's objectives: Pearson product-moment correlation, one-way analysis of variance (ANOVA), and multiple linear regression. All inferential tests were evaluated at the conventional 5 percent level of significance (p less than .05).

(a) Pearson Product-Moment Correlation; Pearson correlation was used to establish the strength and direction of the bivariate relationship between each of the four organizational PRM constructs and project performance prior to regression, as reported in the correlation matrix in Table 17. The Pearson correlation coefficient between two variables x and y was computed as:

Four multiple linear regression models were specified to test the study's general and specific objectives, each regressing a measure of project performance on the same four organizational PRM constructs entered simultaneously: risk identification (RI), risk assessment (RA), risk response planning (RRP), and risk monitoring and control (RMC). The general form of the model was specified as:

3.6 Ethical Considerations

Formal permission was sought from relevant construction organizations and authorities prior to data collection, supported by an official introductory letter from the University explaining the purpose of the study; the researcher complied with all institutional regulations and site requirements to ensure smooth, respectful engagement with participants and organizations.

Informed consent was obtained from all participants before their involvement in the study. Respondents were clearly informed of the purpose of the research, the procedures involved, the expected duration, and how the information collected would be used, were given the opportunity to ask questions, and signed a consent form indicating voluntary agreement to participate.

The confidentiality and privacy of participants were strictly protected throughout the research process. Personal and organizational information obtained during data collection was not disclosed to unauthorized persons; data were used exclusively for academic purposes, and findings are reported in aggregate form to prevent identification of individual respondents or organizations.

The researcher upheld academic integrity by properly acknowledging all sources of information used in the study, with all referenced materials cited in the APA 7th edition referencing style. This thesis is original work, and plagiarism was strictly avoided.

4. Results and Discussion

The results present the study response rate, inferential statistics and the decisions on null hypotheses, followed by objective-based discussion.

4.1 Response Rate

Table 1: Response Rate of the Study

Response Category	Frequency	Percentage
Questionnaires distributed	211	100.0%
Questionnaires returned and usable	207	98.1%
Questionnaires not returned	4	1.9%
Total	**211**	**100.0%**

The response rate of 98.1% indicated a very high level of participation among the targeted respondents. Although the study did not achieve a complete response from all 211 targeted participants, the number of usable responses remained sufficiently high to provide a substantial empirical basis for the statistical analysis. The four non-responses represented only a small proportion of the intended sample and therefore did not materially reduce the volume of information available for the analysis. Importantly, the results reported in the subsequent tables were based on the 207 valid responses rather than the original target of 211.

4.2 Multiple Regression Model

The multiple regression model examined the combined statistical relationship between risk identification, risk assessment, risk response planning, risk monitoring and control, and overall

project performance

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Table 2: Multiple Regression Model Summary

Model	R	R^2	Adjusted R^2	Std. Error	Durbin-Watson
1	0.791	0.625	0.618	0.412	1.892

Dependent Variable: Project Performance

Source: Researcher (2026)

The model produced an R of 0.791, indicating a strong positive combined relationship between the four risk management strategies and overall project performance. The R^2 of 0.625 indicated that approximately 62.5% of the

observed variation in project performance was statistically accounted for by the four risk management variables included in the model. The adjusted R^2 of 0.618 indicated that the explanatory contribution remained substantial after adjustment for the number of predictors.

The result demonstrated that project performance was not associated with a single risk-management activity. Instead, the combined risk-management framework provided substantial explanatory information about differences in project performance. This finding supported the integrated perspective of Enterprise Risk Management Theory, under which risk identification, assessment, response, and monitoring form complementary components of an organizational risk-management system.

The remaining variation in project performance should not be interpreted as evidence that the risk management variables were unimportant. Rather, it indicated that other factors outside the model also contributed to project performance. These could include project financing, contractor capability, procurement efficiency, design quality, leadership, market conditions, stakeholder coordination, technological capacity, and external economic conditions. Therefore, UDL should treat risk management as an important component of project governance rather than as the sole determinant of project success.

Table 3: ANOVA Results for the Regression Model

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	57.294	4	14.324	84.260	0.000
Residual	34.338	202	0.170		
Total	91.632	206			

Source: Researcher (2026)

The ANOVA results showed that the overall regression model was statistically significant, $F(4,202) = 84.260$, $p < 0.001$. This meant that the set of four risk management strategies, considered jointly, provided statistically significant explanatory information about construction project performance.

The significance of the overall model strengthened the interpretation of the individual regression coefficients because it demonstrated that the predictors collectively contributed meaningful information about project performance. The result was also consistent with the broader empirical literature in Rwanda. Nanette and Wabala (2026), for example, reported substantial explanatory power for a model combining risk identification, risk analysis, response planning, and monitoring and control in the Rwanda Urban Development Project.

From a management perspective, the finding implied that improving only one stage of risk management while neglecting the others could limit the effectiveness of the overall system. The four strategies therefore needed to be implemented as an integrated project-management cycle. For UDL, a project risk-management framework should consequently specify responsibilities not only for identifying risks but also for assessing them, responding to them, monitoring their status, and escalating unresolved risks to appropriate management levels.

Table 4: Regression Coefficients

Predictor	B	SE	Standardized β	t	Sig.
Constant	0.412	0.145	—	2.841	0.005
Risk Identification	0.295	0.058	0.312	5.086	<0.001
Risk Assessment	0.148	0.052	0.168	2.846	0.005
Risk Response Planning	0.305	0.059	0.328	5.169	<0.001
Risk Monitoring and Control	0.186	0.054	0.201	3.444	0.001

Dependent Variable: Project Performance

Source: Researcher (2026)

The regression equation was:

$$\mathbf{Y = 0.412 + 0.295\ X1 + 0.148X2 + 0.305\ X3 + 0.186\ X4 + \varepsilon}$$

The results indicated that all four predictors had positive and statistically significant coefficients. Risk response planning had the largest standardized coefficient ($\beta = 0.328$), followed by risk identification ($\beta = 0.312$), risk monitoring and control ($\beta = 0.201$), and risk assessment ($\beta = 0.168$). This indicated that, after accounting for the other risk-management strategies in the model, differences in response planning were associated with the largest unique change in project performance among the four predictors.

The relatively strong coefficient for risk response planning was substantively meaningful. Identification and assessment primarily generated information about uncertainty, whereas response planning translated that information into decisions and actions. Consequently, the finding suggested that the value of identifying and assessing risks was realized more fully when project teams had practical mechanisms for mitigation, transfer, avoidance, acceptance, contingency allocation, and risk ownership. This interpretation was consistent with

Nkiranuye et al. (2025), who found significant relationships between risk planning and project performance among large construction companies in Rwanda.

Risk monitoring and control also demonstrated a statistically significant contribution. This finding reinforced the importance of maintaining feedback between planned project conditions and actual implementation. The coefficient was smaller than those of risk response planning and risk identification, but it remained practically important because an effective response could lose its value if project teams did not subsequently monitor whether the response had actually reduced exposure.

Risk assessment produced the smallest coefficient, although it remained statistically significant. This should not be interpreted as meaning that risk assessment was unimportant. Rather, the descriptive results suggested that the assessment process was still relatively dependent on basic qualitative methods, while advanced quantitative tools were less frequently applied. Consequently, the relatively smaller coefficient may have reflected limitations in the depth and sophistication of assessment practices rather than the inherent importance of risk analysis.

4.3 Pearson Correlation Analysis

Table 5: Pearson Correlation Matrix

Variable	X_1	X_2	X_3	X_4	Y_1	Y_2	Y_3	Y
Risk Identification (X_1)	1.000							
Risk Assessment (X_2)	.582**	1.000						
Risk Response (X_3)	.614**	.602**	1.000					
Risk Monitoring (X_4)	.558**	.541**	.589**	1.000				
Cost Performance (Y_1)	.512**	.485**	.598**	.521**	1.000			
Time Performance (Y_2)	.534**	.491**	.612**	.574**	.642**	1.000		
Quality Performance (Y_3)	.618**	.510**	.542**	.498**	.588**	.615**	1.000	
Overall Performance (Y)	.612**	.541**	.624**	.578**	.824**	.841**	.812**	1.000

Note: Correlation was significant at the 0.01 level (two-tailed).

Source: Researcher (2026)

The correlation results showed positive and statistically significant relationships between each risk-management strategy and overall project performance. Risk response planning recorded the strongest correlation with overall performance (r = .624), followed by risk identification (r = .612), risk monitoring and control (r = .578), and risk assessment (r = .541). The results therefore showed a consistent pattern in which stronger risk-management practices were associated with better perceived project performance.

At the performance-dimension level, risk identification had the strongest relationship with quality performance (r = .618), while risk response planning had the strongest relationship with time performance (r = .612). Risk response planning also had the strongest relationship with cost performance (r = .598). This pattern suggested that different stages of risk management may have particular practical relevance for different dimensions of project performance. Early identification may help prevent technical defects and rework, while timely response planning may help protect project schedules and costs.

However, the correlations in the present study should be interpreted as associations rather than proof of causality. Because the research design was based on observed respondent data rather than an experimental intervention, the results showed that the variables moved together in the study population. The regression analysis provided additional evidence of statistical contribution after controlling for the other predictors, but it did not establish that changing a risk-management practice in isolation would mechanically produce a specific increase in project performance.

4.4 Hypothesis Testing

Table 1: Hypothesis Testing Outcomes

Hypothesis	β	t	p-value	Decision
H_{01}: Risk identification had no statistically significant influence on project performance.	0.295	5.086	<0.001	Rejected
H_{02}: Risk assessment and analysis had no statistically significant effect on project performance.	0.148	2.846	0.005	Rejected
H_{03}: Risk response planning had no statistically significant influence on project performance.	0.305	5.169	<0.001	Rejected

H_{04}: Risk monitoring and control had no statistically significant effect on project performance.	0.186	3.444	0.001	Rejected

Source: Researcher (2026)

The hypothesis tests showed that all four null hypotheses were rejected at the 5% significance level. This meant that each of the four risk-management dimensions demonstrated a statistically significant positive relationship with construction project performance when examined within the specified regression model. The findings therefore provided empirical support for the central proposition of the study that risk management practices were significantly associated with the performance of UDL commercial construction projects.

The rejection of the hypotheses did not mean that the four practices had identical importance. The standardized coefficients showed meaningful differences in their relative statistical contributions. Risk response planning had the largest coefficient, while risk assessment had the smallest. Therefore, the findings supported an integrated risk-management approach while also indicating that strengthening practical response mechanisms could be particularly important for project outcomes.

4.5 Discussion of Research Findings

The discussion interprets the results against the empirical literature and theoretical perspectives for each study objective.

4.5.1 Risk Identification Strategies and Project Performance

The study established that risk identification had a positive and statistically significant association with project performance, consistent with the construction-project evidence reported by Igihozo and Irechukwu (2022). The regression coefficient was positive and significant, while the correlation coefficient also indicated a moderate-to-strong positive association. The descriptive findings further showed that risk identification had been implemented at a moderate overall level. This combination was important because it demonstrated that risk identification was not merely a procedural activity; variations in the extent to which risks were identified were statistically associated with differences in perceived project performance.

The practical implication was that UDL needed to move from identifying mainly familiar or standardized risks toward identifying assumptions and emerging risks. A risk register should therefore be complemented by structured workshops in which project teams challenge assumptions relating to material prices, design completeness, contractor capacity, regulatory approvals, procurement lead times, financing conditions, and stakeholder requirements. As explained by von Bertalanffy (1968), Systems Theory emphasizes the interdependence of system components; such early identification was therefore important because a problem arising in one subsystem could subsequently affect other parts of the project. Consistent with International Organization for Standardization (2018), the actionable recommendation was therefore to require documented risk-identification workshops at major project gateways and to update the risk register whenever project scope, market conditions, design, procurement arrangements, or contractual circumstances changed.

4.5.2 Risk Assessment and Analysis Strategies and Project Performance

Risk assessment and analysis had a positive and statistically significant relationship with project performance, although its standardized regression coefficient was the smallest among the four predictors. The descriptive findings explained this pattern by showing that basic qualitative risk prioritization was more commonly practiced than advanced quantitative assessment. Thus, the issue was not the absence of risk assessment but the relatively limited analytical depth with which risks were assessed, a distinction relevant to the risk-analysis framework of International Organization for Standardization (2018).

The practical implication was that UDL should strengthen quantitative risk-analysis capability rather than relying primarily on subjective probability-impact matrices. For major projects, risk analysis should where appropriate estimate potential cost and schedule exposure, compare alternative response scenarios, and inform contingency decisions, as outlined in the Project Management Institute (2021) risk-management framework. This recommendation also accords with the principles of risk evaluation and context considered by International Organization for Standardization (2018), because the sophistication of risk analysis should correspond to the complexity, value, uncertainty, and potential consequences associated with the project. A practical improvement would involve training project teams in expected monetary value, sensitivity analysis, decision-tree analysis, and Monte Carlo simulation and requiring their use for major risks where sufficient data were available.

4.5.3 Risk Response Planning Strategies and Project Performance

Risk response planning recorded the strongest standardized regression coefficient among the four predictors and also the strongest correlation with overall project performance. The result indicated that the transition from recognizing a risk to deciding and implementing what should be done about it was particularly important in the study setting, consistent with Nkiranuye et al. (2025). The descriptive findings further showed that contractual risk transfer was relatively well established, while risk-based contingency planning and clear assignment of risk ownership were less consistently practiced.

This finding was consistent with Nkiranuye et al. (2025), whose study of large construction companies in Rwanda

reported significant relationships between risk planning, mitigation, monitoring, and project performance. It was also consistent with Ingabire and Kwena (2025), whose study of road construction at Nyarutarama Property Developers examined risk reduction, transfer, avoidance, and retention in relation to timely completion. These findings collectively suggested that construction organizations benefited when identified risks were translated into explicit response measures rather than remaining as entries in risk registers.

The implication for UDL was that every significant risk should have a corresponding response package. Such a package should specify the selected response strategy, responsible person, required resources, implementation deadline, trigger conditions, escalation path, and expected outcome. The enterprise risk management framework of the Committee of Sponsoring Organizations of the Treadway Commission (2017) supported this approach because risk management created organizational value when uncertainty was translated into informed decisions. In practical terms, UDL should establish a rule that high-priority risks could not remain "open" without a documented and funded response. This would be particularly important for risks relating to contractor performance, imported materials, design variations, price escalation, financing, and regulatory approvals.

4.5.4 Risk Monitoring and Control Mechanisms and Project Performance

Risk monitoring and control had a positive and statistically significant relationship with project performance. The descriptive findings showed moderate implementation, with site reviews and risk reassessment following variations being more common than formal Earned Value Management and contingency burn-rate monitoring. The results therefore suggested that monitoring was taking place but that its financial and quantitative dimensions required further institutionalization, consistent with findings on risk-management practices reported by Sangwa and Dushimimana (2023).

The finding was strongly supported by the feedback principle of Systems Theory (von Bertalanffy, 1968), because monitoring generated the feedback required for corrective action. A project could only remain within acceptable performance parameters when deviations were detected and communicated early enough for management to act. Accordingly, UDL should integrate site inspections with Earned Value Management, schedule variance analysis, contingency monitoring, risk-register reviews, change-order monitoring, and management reporting, consistent with the monitoring principles in Project Management Institute (2021). A practical scenario would involve establishing a weekly risk-control dashboard that identifies the top unresolved risks, changes in risk exposure, cost variance, schedule variance, contingency utilization, and outstanding corrective actions. Such a system would enable management to respond before emerging deviations became major project failures.

5. Conclusions and Recommendations

5.1 Conclusions

The study concluded that systematic risk identification was important for construction project performance. The relatively stronger use of standardized checklists demonstrated that UDL commercial projects had established basic mechanisms for recognizing common risks. However, the lower emphasis on critical analysis of assumptions showed that some risks could remain hidden because teams were not always challenging the assumptions on which project plans were based.

The study concluded that risk assessment and analysis contributed positively to project performance but remained an area requiring greater analytical maturity. The continued use of basic qualitative risk matrices provided a useful foundation, but the relatively low use of quantitative tools limited the ability of project teams to estimate the potential financial and schedule consequences of complex risks.

The study concluded that risk response planning had the strongest unique statistical contribution to project performance among the four risk-management strategies. This finding demonstrated that risk information became most valuable when it was translated into specific management actions. A project team could identify and assess hundreds of risks, but project performance would not necessarily improve unless important risks were accompanied by appropriate responses.

The study concluded that monitoring and control contributed significantly to project performance because risk conditions changed throughout construction. A risk that appeared manageable during planning could become more serious because of a design variation, procurement delay, market shock, contractor problem, or regulatory development.

5.2 Recommendations

Based on the findings, the following recommendations are proposed for strengthening construction project performance:

1. UDL management and RSSB project executive committees should institutionalize updated risk registers and multidisciplinary risk identification reviews at the earliest project stages.
2. Project teams should strengthen systematic risk assessment through probability-impact analysis, quantitative evaluation where appropriate, and documented risk prioritization.
3. Contractors and consultants should assign clear risk owners and adopt proportionate mitigation, contingency and contractual risk-allocation arrangements.
4. Project managers should conduct regular risk monitoring, site inspections, variance reviews and corrective-action follow-up throughout implementation.
5. Policy and regulatory stakeholders should encourage integrated risk management

procedures, technical training and consistent construction oversight.

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