RISK MITIGATION STRATEGIES AND TIMELY COMPLETION OF ROAD CONSTRUCTION PROJECTS AT NYARUTARAMA PROPERTY DEVELOPERS RWANDA

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ABSTRACT

The general objective of this study was to investigate the effect of risk mitigation strategies on the timely completion of road construction projects at Nyarutarama Property Developers (NPD) Rwanda. The specific objectives were to determine the effect of risk reduction, risk transfer, risk avoidance and risk retention on the timely completion of road construction projects at Nyarutarama Property Developers (NPD) Rwanda. The study employed descriptive survey design, combining quantitative surveys and qualitative interviews. Data was collected from a target population of 319 NPD employees, with a sample size of 178, using stratified random sampling. The study incorporated both primary and secondary data. Validity and reliability of the instruments was ensured through expert reviews and pre-tests, and data was analyzed using SPSS, employing both descriptive and inferential statistics. The results indicated that the variables of risk reduction, risk avoidance, and risk retention significantly impact the timely completion of road construction projects. Specifically, risk reduction (B = 0.295, p < 0.001) and risk avoidance (B = 0.685, p < 0.001) have the strongest positive relationships with timely completion, with risk avoidance showing the highest standardized coefficient (Beta = 0.640), suggesting it has the greatest influence. Risk retention also positively affects timely completion (B = 0.115, p = 0.001), albeit to a lesser extent. In contrast, risk transfer (B = 0.045, p = 0.165) was not found to have a statistically significant effect on timely completion, indicating that it may not be as influential in this context. In conclusion, the study found that risk reduction, risk avoidance, and risk retention significantly contribute to the timely completion of road construction projects, while risk transfer had a minimal effect. It was recommended that Nyarutama Property Developers (NPD) enhance the implementation of risk reduction and avoidance strategies to further improve project outcomes. Further studies could explore the long-term effects of these risk management strategies on project success and investigate the potential integration of new risk management technologies in the construction industry.

Keywords: Risk Mitigation, Road Construction, Project Management, Timely Completion, Infrastructure Development.

INTRODUCTION

Risk mitigation strategies play a crucial role in ensuring the successful and timely completion of construction projects worldwide. Across the globe, the construction industry is subject to a wide range of risks, including financial instability, unpredictable weather conditions, labor shortages, and technical complexities, all of which can lead to delays and cost overruns. According to Antwi-Afari *et al.* (2020), effective risk management is essential to maintaining project timelines and preventing delays that can hinder economic development. Globally, organizations are increasingly adopting risk mitigation strategies such as risk assessment, contingency planning, and stakeholder collaboration to navigate these challenges and achieve timely project delivery.

In recent years, the importance of risk mitigation in infrastructure projects has gained attention in both developed and developing nations. A global perspective shows that countries with well-established risk management frameworks have higher success rates in completing construction projects on time. For instance, in developed countries, such as the United States and the United Kingdom, project managers leverage advanced technologies like Building Information Modeling (BIM) to identify potential risks early in the construction process (Chen et al., 2021). These strategies not only reduce delays but also enhance the overall efficiency and cost-effectiveness of construction projects.

In Sub-Saharan Africa, the construction sector faces unique risks such as political instability, fluctuating commodity prices, and inadequate infrastructure, which often lead to project delays. According to Osei-Kyei and Chan (2022), the lack of adequate risk mitigation strategies has been a significant factor in the failure of construction projects to meet their deadlines in the region. However, there is growing recognition of the importance of integrating comprehensive risk management practices to improve the performance of road construction projects, especially in the face of rapid urbanization and infrastructure development demands across Sub-Saharan Africa.

East Africa has seen an increasing focus on infrastructure development, particularly in road construction, as part of the region's economic growth strategies. In countries like Kenya, Uganda, and Tanzania, large-scale road construction projects are critical to boosting regional connectivity and trade. However, project delays remain a common challenge due to inadequate risk management practices, insufficient funding, and poor project planning. Mungai and Mwenda (2021) highlight that in East Africa, the adoption of formal risk mitigation strategies, including financial risk management and stakeholder involvement, is key to ensuring the timely completion of road construction projects.

In Rwanda, road construction is a priority for the government as part of its Vision 2050 development strategy, which aims to transform the country into a middle-income economy through infrastructure development. However, the timely completion of road projects has often been hindered by risks such as funding shortages, environmental challenges, and poor project management. According to Ndayambaje and Nkurunziza (2023), implementing effective risk mitigation strategies, including detailed risk assessments and proactive resource management, has proven to significantly improve project timelines in Rwanda's road construction sector. This study aims to evaluate the impact of risk mitigation strategies on the timely completion of road construction projects at Nyarutarama Property Developers (NPD) Rwanda.

Statement of the Problem

In Rwanda, road construction projects are a critical component of the country's infrastructure development, aligned with its Vision 2050 to transform into a middle-income economy. Despite the government's efforts, many road construction projects continue to face significant delays and cost overruns due to inadequate risk management practices. According to the Rwanda Transport Development Agency (RTDA), approximately 30% of road construction projects in the past decade experienced delays of over six months, primarily due to poor risk mitigation strategies, including insufficient financial planning, weak project supervision, and unforeseen environmental challenges (Ndayambaje & Nkurunziza, 2023). These delays not only hinder

economic development but also affect public confidence in infrastructure projects. The construction industry is particularly vulnerable to risks such as inadequate planning, unforeseen environmental challenges, and poor risk management practices (Kigabo *et al.*, 2023).

Although some studies have explored risk management practices in Rwanda's construction sector, there remains a gap in understanding how specific risk mitigation strategies can be effectively implemented to ensure timely project completion. Existing literature, such as the work of Mpinganzima *et al.* (2021), highlights general risk factors affecting construction projects but lacks a detailed analysis of how proactive risk mitigation can address these issues in road construction specifically. While several studies have investigated risk management in Rwanda's construction industry, there is limited research on the practical application of specific risk mitigation strategies to enhance timely completion of road construction projects. Existing literature, such as Mpinganzima et al. (2021), focuses on broad risk factors but lacks an in-depth analysis of proactive risk management approaches tailored to road construction. Furthermore, research has not sufficiently addressed how private developers, such as Nyarutarama Property Developers (NPD), can implement targeted risk mitigation strategies to minimize delays and cost overruns. This study seeks to bridge this gap by exploring effective risk management practices that can enhance the efficiency and success of road construction projects in Rwanda.

Objectives of the Study

The general objective of this study was to investigate the effect of risk mitigation strategies on the timely completion of road construction projects at Nyarutarama Property Developers Rwanda. The study was guided by the following specific objectives:

- To determine the effect of risk reduction on the timely completion of road construction projects at Nyarutarama Property Developers Rwanda.
- To assess the effect of risk transfer on the timely completion of road construction projects at Nyarutarama Property Developers Rwanda.
- To examine the effect of risk avoidance on the timely completion of road construction projects at Nyarutarama Property Developers Rwanda.
- To establish the effect of risk retention on the timely completion of road construction projects at Nyarutarama Property Developers Rwanda.

LITERATURE REVIEW

Conceptual Framework

A conceptual framework serves as the theoretical foundation guiding research endeavors, providing a structure for understanding and analyzing complex phenomena. According to Miles and Huberman (2019), a conceptual framework offers a systematic approach to organizing concepts, variables, and relationships, facilitating the formulation of hypotheses and research questions. The conceptual framework delineates the theoretical constructs underpinning the study, helping researchers interpret findings and draw meaningful conclusions (Hancock & Algozzine, 2020). It provides a lens through which researchers can conceptualize, contextualize, and interpret empirical evidence, enhancing the rigor and validity of research outcomes (Creswell & Creswell, 2019). By integrating relevant theories, models, and empirical evidence, a conceptual framework contributes to the advancement of knowledge within a particular field of inquiry, guiding future research directions (Tuckman & Harper, 2022). The conceptual framework delineates the dependent and independent variables, as expounded upon in the literature study and further elucidated in Figure 1 elucidates the interconnection between the independent and dependent variables.
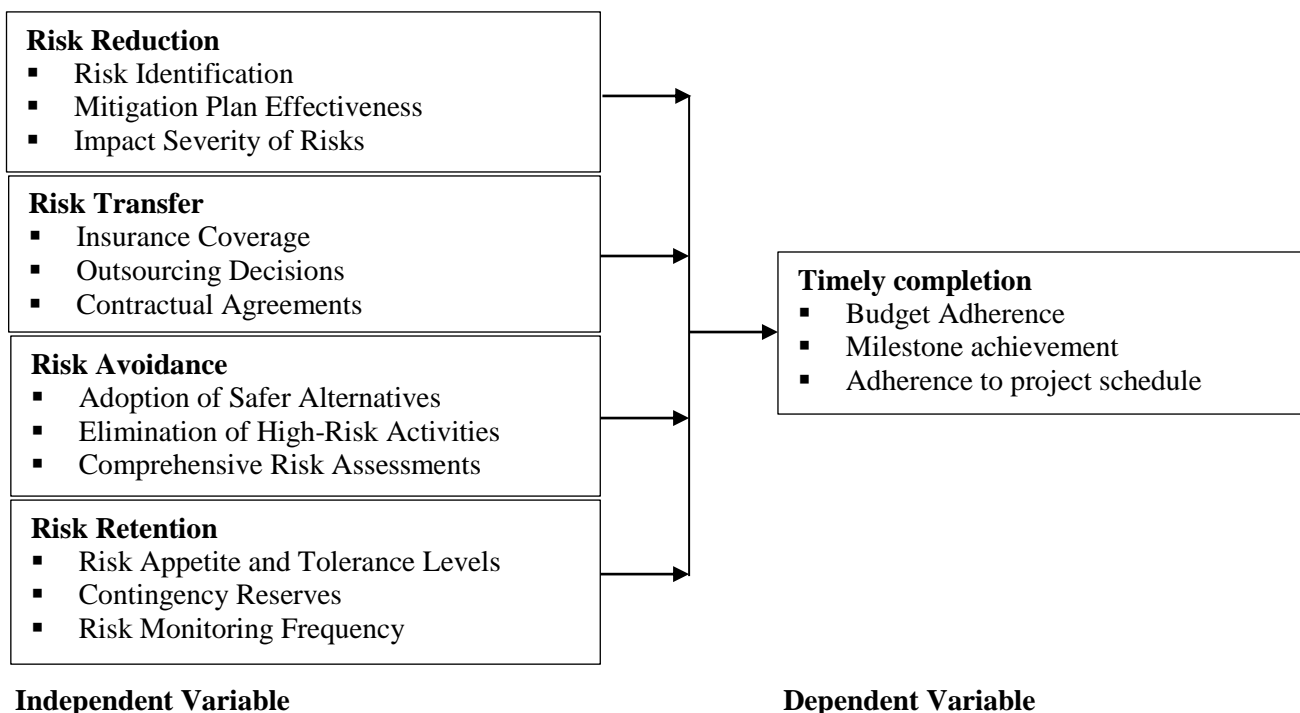
Risk Reduction ▪ Risk Identification ▪ Mitigation Plan Effectiveness ▪ Impact Severity of Risks	
Risk Transfer ▪ Insurance Coverage ▪ Outsourcing Decisions ▪ Contractual Agreements	**Timely completion** ▪ Budget Adherence ▪ Milestone achievement ▪ Adherence to project schedule
Risk Avoidance ▪ Adoption of Safer Alternatives ▪ Elimination of High-Risk Activities ▪ Comprehensive Risk Assessments	
Risk Retention ▪ Risk Appetite and Tolerance Levels ▪ Contingency Reserves ▪ Risk Monitoring Frequency	

Independent Variable   **Dependent Variable**

Figure 1: Conceptual Framework

Source: Researcher, 2024

The conceptual framework for this study aims to examine how different risk management strategies influence the timely completion of road construction projects at Nyarutarama Property Developers, Rwanda. Specifically, the study focuses on four key strategies: risk reduction, risk transfer, risk avoidance, and risk retention. Risk reduction refers to efforts made to minimize the probability and impact of project risks (Smith & Jones, 2023), while risk transfer involves shifting the responsibility for certain risks to third parties (Nguyen et al., 2022). Risk avoidance entails altering project plans to eliminate risks entirely (Martinez & Garcia, 2021), and risk retention means accepting and managing risks internally when the cost of mitigating them is too high (Lee & Kim, 2020). Each of these strategies is examined to determine its effect on the timely completion of road construction projects, contributing to the overall understanding of risk management in the construction industry.

Research Gaps

A critical review of existing literature reveals that while significant progress has been made in understanding risk management in construction projects, particularly in developing countries, gaps remain in the context of specific risk mitigation strategies for road construction projects in Rwanda. Several studies highlight the importance of risk management practices such as risk reduction and transfer in enhancing project performance. For example, Hassan et al. (2021) emphasizes the role of comprehensive risk management frameworks in mitigating delays and ensuring project success in construction projects across Africa. However, there is limited research specifically addressing how these strategies impact the timely completion of road construction projects in Rwanda. Most studies focus on broader construction projects, with little attention to how unique local factors, such as regulatory environments, market conditions, and resource availability, influence the effectiveness of risk mitigation strategies in road construction (Nassif & El-Sayegh, 2020; Jamil & Yusoff, 2022).

Furthermore, while general risk management frameworks, such as the one proposed by Project Management Institute (PMI, 2021), are widely adopted, they often lack specific adaptation to local contexts like Rwanda,

where infrastructure projects face distinct challenges. The role of risk avoidance and retention in ensuring timely project delivery has also received limited attention, particularly in relation to road construction projects in sub-Saharan Africa. Studies by Karanja et al. (2020) and Kamau et al. (2022) suggest that risk avoidance, which involves eliminating or reducing the impact of identified risks, is often underutilized in the region. Additionally, while existing literature extensively explores risk transfer, through mechanisms like insurance and contracting, there is a notable lack of detailed empirical studies on how risk retention impacts project timelines in the context of road construction. Therefore, there is a significant gap in literature regarding the specific risks and strategies that affect the timely completion of road construction projects in Rwanda, particularly at firms like Nyarutama Property Developers.

The research gap in this study can be classified into three key categories: theoretical, empirical, and contextual gaps. Theoretically, while existing risk management frameworks identify broad risk factors in construction, there is limited focus on how specific mitigation strategies—such as risk reduction, transfer, avoidance, and retention—impact the timely completion of road construction projects. Empirically, most studies on risk management in Rwanda's construction sector, such as those by Mpinganzima *et al.* (2021), provide general insights but lack detailed, data-driven analysis on the direct effects of different risk mitigation strategies on project timelines. Contextually, prior research has primarily examined public infrastructure projects, leaving a gap in understanding how private developers like Nyarutarama Property Developers (NPD) manage risks to ensure timely project completion.

METHODOLOGY

The study adopted a descriptive research design to assess the risk mitigation strategies and their impact on the timely completion of road construction projects at Nyarutama Property Developers (NPD) Rwanda. A descriptive design is ideal for understanding the characteristics of the risk management practices employed by NPD, as it allows for the systematic collection, analysis, and interpretation of data related to the various risk mitigation strategies (Zikmund *et al.,* 2020).

The target population for this study consists of 319 professionals employed at Nyarutama Property Developers (NPD) Rwanda, specifically those directly involved in road construction projects. The study focused on a diverse group of individuals, including 35 road designers, 30 surveyors, 40 site engineers, 25 quantity surveyors, 20 geotechnical engineers, 30 electrical engineers, 35 structural engineers, 25 materials engineers, 30 mechanical engineers, 5 project managers, and 34 quality control engineers. This population was selected due to their direct involvement in the risk management and implementation of road construction projects, allowing the study to gather a comprehensive understanding of the effectiveness of various risk mitigation strategies. According to Mugenda and Mugenda (2020), when conducting studies in organizational settings, selecting a population that encompasses all relevant roles within a project is crucial for obtaining reliable and applicable data.

The sample size was attained through the use following the formula used by Yamane's formula as stipulated by Kothari (2019).

$$n = \frac{N}{1 + N\,(e)^2} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . \dots \dots Eqn\ 1$$

Where n = the sample size.

e = probability of error, i.e., the desired precision, 0.05 for 95% confidence.

When doing research, the choice between studying the whole population or opting for a representative subset (sample) is influenced by variables such as practicality, resources, and research goals. Researchers may easily

collect data and ensure relevant and generalizable conclusions by choosing sampling. The research uses Kothari's (2019) formula to determine the sample size, which is a well-accepted method for calculating the required sample size considering aspects like confidence level, margin of error, and demographic variability. This approach allows researchers to reconcile statistical rigor with practical data gathering limits, therefore improving the reliability and validity of study results.

$$n = \frac{N}{1 + N * e^2} = n = \frac{319}{1 + 319\,(0.05)^2} \approx 177.5 = 178$$

As a consequence of this, the sample size that was examined for the purpose of providing the main data that is necessary for this study is that of 178 staff members.

Table 1: Sampling Frame

Area of operation	Population	Sample
Road designers	35	20
Surveyors	30	17
Site engineers	40	22
Quantity surveyors	25	14
Geotechnical Engineers	20	11
Electrical Engineers	30	17
Structural Engineers	35	20
Materials Engineers	25	14
Mechanical Engineers	30	17
Project managers	5	3
Quality Control Engineers	34	19
Total	**319**	**178**

Source: Human Resource Department Kigali Infrastructure Project – (2024)

The study adopted a stratified random sampling technique to ensure that all relevant groups within the target population are adequately represented. Stratified random sampling is appropriate for this study as it allows the researcher to divide the population into distinct subgroups, or strata, based on their roles in the road construction projects at Nyarutama Property Developers (NPD), such as road designers, surveyors, engineers, and project managers. From each stratum, a random sample was selected to participate in the study, ensuring that the diverse perspectives of all involved parties are captured (Creswell, 2021).

The study used data collection instruments and methods based on the objectives of the study. The study adopted both primary and secondary data.

A mixed-method approach is suitable because it combines the strengths of both qualitative and quantitative methods, providing a comprehensive understanding of the research problem.

The primary data collection method that was adopted by this study is the use of structured questionnaires and semi-structured interviews. Structured questionnaires were distributed to a sample of professionals within the target population at Nyarutama Property Developers (NPD) Rwanda, including road designers, surveyors, engineers, and project managers, to gather quantitative data on the risk mitigation strategies used in road construction projects and their impact on timely completion. This method is effective for capturing measurable data, as it allows respondents to answer standardized questions that can be analyzed statistically (Creswell, 2021). Additionally, semi-structured interviews were conducted with a select group of project managers and senior engineers to gain deeper insights into their experiences with risk management strategies. This qualitative method provides flexibility, allowing respondents to elaborate on their perspectives and provide detailed, contextual information (Bryman, 2021).

Additionally, interviews included representatives from local government agencies involved in the regulatory aspects and oversight of the infrastructure development. These interviews are essential to understanding the perspectives of those managing the risks, as well as the effectiveness of the strategies employed in ensuring the timely completion of the 215 kilometers of asphalt roads (Gatsinzi & Nyandwi, 2022; Ndungu & Omondi, 2021). The combination of these two methods ensured that the study captures both quantitative and qualitative data, offering a comprehensive understanding of the factors influencing project timelines.

The study adopted secondary data collection methods to complement primary data and provide a broader context for analyzing the effectiveness of risk mitigation strategies in road construction projects at Nyarutama Property Developers (NPD) Rwanda. Secondary data was gathered from existing project documents, including project reports, risk management plans, progress tracking reports, and completion timelines of previous road construction projects. These documents provided valuable insights into how risks were managed throughout the lifecycle of the projects, particularly in terms of time-related challenges and the application of mitigation strategies such as risk reduction, transfer, avoidance, and retention.

A sample of 18 respondents, representing 10% of the total sample size of 178, was selected for a pilot test. To ensure the accuracy and reliability of the findings, the study employed a mixed-methods approach, which is widely regarded as effective in construction and project management research (Creswell, 2021). The validity of the instruments used in this study was ensured through a thorough process of content and construct validation. To assess content validity, the research instruments, including surveys and interview guides, were reviewed by experts in the field of project management and risk mitigation to ensure that they comprehensively cover all relevant aspects of the study's objectives (Sekaran & Bougie, 2020).

The reliability of the instruments used in this study was ensured through a pre-test conducted with a small sample drawn from the target population at Nyarutama Property Developers (NPD) Rwanda. The reliability of the survey and interview questions were tested using Cronbach's Alpha coefficient to measure internal consistency, with a threshold of 0.7 considered acceptable (Tavakol & Dennick, 2021).

The data processing and analysis for this study followed a structured approach, utilizing SPSS version 25 to ensure accuracy and reliability in the results. For the data analysis, descriptive statistics were employed first to provide an overview of the dataset. Frequencies, percentages, means, and standard deviations was used to summarize the characteristics of the variables, offering insights into the distribution of responses regarding the different risk mitigation strategies (Laerd Statistics, 2021). These descriptive statistics provided a baseline understanding of the data before conducting more complex inferential statistical tests. Inferential statistics was employed to examine the relationships between risk mitigation strategies and the timely completion of road construction projects. Correlation and linear regression analysis were conducted to assess how risk reduction, transfer, avoidance, and retention (independent variables) influence the timely completion (dependent variable). The linear regression model were specified as

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\text{(Equation 2)}$$

where Y represents the timely completion of road projects, and X1 to X4 represent the risk mitigation strategies.

X_1 = Risk reduction

X_2 = Risk transfer

X_3 = Risk avoidance

X_4 = Risk retention

In addition to correlation and regression analysis, an Analysis of Variance (ANOVA) was conducted to test for statistically significant differences between the groups of professionals involved in the study (e.g.,

engineers, project managers, and surveyors) in terms of their perception of risk mitigation strategies. This helped identify whether the different roles at NPD perceive the impact of these strategies differently. Coefficients from the regression model provided an estimate of the strength and direction of the relationship between each independent variable and the dependent variable. The results were presented in tables and figures for clarity, making it easier to interpret the relationships between risk mitigation strategies and project timelines. The final report incorporated visual aids such as graphs and charts to support the interpretation of statistical findings, ensuring that the results are easily understood by both academic and professional audiences (Field, 2020).

RESULTS AND FINDINGS

Correlation Analysis

Table 2 presents the correlation matrix, which explores the relationships between key variables related to risk mitigation strategies and the timely completion of road construction projects at Nyarutarama Property Developers. The matrix highlights the strength and direction of associations between risk reduction, risk transfer, risk avoidance, risk retention, and the timely completion of projects. By analyzing these correlations, the table provides a deeper understanding of how different risk management strategies interact and influence project outcomes. The findings from the correlation analysis help identify which risk mitigation practices are most strongly associated with the successful and timely delivery of construction projects, offering valuable insights for improving project management practices.

Table 2: Correlations Matrix

		Risk Reduction	Risk Transfer	Risk Avoidance	Risk retention	Timely Completion
Risk Reduction	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	170				
Risk Transfer	Pearson Correlation	.027	1			
	Sig. (2-tailed)	.729				
	N	170	170			
Risk Avoidance	Pearson Correlation	.828**	.045	1		
	Sig. (2-tailed)	.000	.558			
	N	170	170	170		
Risk Retention	Pearson Correlation	.409**	.022	.516**	1	
	Sig. (2-tailed)	.000	.780	.000		
	N	170	170	170	170	
Timely Completion	Pearson Correlation	.834**	.079	.912**	.547**	1
	Sig. (2-tailed)	.000	.308	.000	.000	
	N	170	170	170	170	170

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

Source: Primary data, (2024).

Table 2 presents the correlation matrix among various factors related to road construction project management at Nyarutarama Property Developers (NPD), including Risk Reduction, Risk Transfer, Risk Avoidance, Risk Retention, and Timely Completion. The correlation between Risk Reduction and Risk Avoidance is very strong (r = 0.828, p < 0.01), indicating that practices aimed at reducing risks are closely linked to those intended to avoid risks in the project context. This alignment suggests that when risk reduction strategies are

employed, risk avoidance practices tend to be similarly emphasized. Furthermore, Risk Reduction shows a moderate positive correlation with Risk Retention (r = 0.409, p < 0.01), suggesting that an increased focus on reducing risks is associated with thorough risk Retention. The correlation between Risk Reduction and Timely Completion is also strong (r = 0.834, p < 0.01), emphasizing that effective risk reduction contributes significantly to completing projects on schedule (Akinwale & Adegbite, 2021).

The analysis also reveals interesting insights regarding Risk Transfer, which has a very weak and statistically insignificant correlation with most factors. Specifically, the correlation with Risk Reduction (r = 0.027, p = 0.729) and Retention (r = 0.022, p = 0.780) indicates that these aspects of project risk management are not strongly related to transferring risk. The weak correlation between Risk Transfer and Timely Completion (r = 0.079, p = 0.308) further supports this, suggesting that transferring risks might not directly influence the project's ability to meet deadlines. Conversely, Risk Avoidance shows a strong and highly significant positive correlation with Timely Completion (r = 0.912, p < 0.01), reflecting that strategies aimed at avoiding risks significantly enhance the likelihood of completing projects within the planned timeline. Overall, the data underscores the critical role of risk management practices, particularly risk reduction and avoidance, in ensuring project success (Nguyen et al., 2020; Akinwale & Adegbite, 2021).

Multiple Regression Analysis

Regression analysis is a powerful statistical tool used to examine the relationships between dependent and independent variables, helping to predict outcomes and identify underlying patterns. In project management and construction contexts, regression analysis is often used to assess how various factors, such as risk management practices or financial strategies, influence project outcomes, including timeliness and cost efficiency (Zhang & Xie, 2021). By estimating the strength and direction of these relationships, regression models allow researchers to quantify the impact of specific variables on project success (Almalki & Aziz, 2020). Recent studies have demonstrated that regression analysis can reveal significant correlations between risk management strategies and project performance, providing insights that can enhance decision-making and improve project planning (Nguyen et al., 2021).

Table 3 indicates that the combined model, which includes risk reduction, risk transfer, risk avoidance, and risk retention as predictors, explains a significant proportion of the variance in timely completion. The R value of 0.929 suggests a very strong positive relationship between the predictors and timely completion, with an R square value of 0.862, meaning that approximately 86.2% of the variance in timely completion is explained by these four risk management strategies. The adjusted R square value of 0.859, which accounts for the number of predictors in the model, further supports the model's robustness. The relatively low standard error of the estimate (0.10348) suggests that the model's predictions are precise and reliable. This indicates that combining these risk management strategies provides a comprehensive approach to ensuring the timely completion of projects (Lee & Kim, 2022).

Table 3: Combined Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.929[a]	.862	.859	.10348

a. Predictors: (Constant), Risk Reduction, Risk Transfer, Risk Avoidance and Risk Retention
b. Dependent Variable: Timely Completion

Source: Primary data, (2024).

Table 4 shows that the combined model, which includes risk retention, risk avoidance, risk reduction, and risk transfer as predictors, significantly impacts timely completion. The regression sum of squares of 11.046, along with the mean square of 2.762, results in an F-value of 257.915, which is highly significant (p < 0.001). This indicates that the model as a whole is effective in explaining variations in timely completion. The residual sum of squares of 1.767 and the residual mean square of 0.011 suggest that the unexplained variance in the

dependent variable is minimal. These findings highlight that the combined risk management strategies are crucial in ensuring the timely completion of projects (Chen, Zhang & Wang, 2021).

Table 4: Combined ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.046	4	2.762	257.915	.000[b]
	Residual	1.767	165	.011		
	Total	12.813	169			

a. Dependent Variable: Timely Completion
b. Predictors: (Constant), Risk Retention, Risk Avoidance, Risk Reduction, Risk Transfer

Source: Primary data, (2024).

Table 5 presents the combined regression coefficients for risk reduction, risk transfer, risk avoidance, and risk retention in predicting timely completion. The results indicate that risk reduction (B = 0.295, $p < 0.001$), risk avoidance (B = 0.685, $p < 0.001$), and risk retention (B = 0.115, p = 0.001) have significant positive effects on timely completion, with risk avoidance having the largest impact ($\beta = 0.640$). On the other hand, risk transfer (B = 0.045, p = 0.165) does not significantly affect timely completion, as indicated by its high p-value. The negative constant (B = -0.608, p = 0.005) suggests that in the absence of these risk management strategies, timely completion may be hindered. These findings underline the importance of risk reduction, avoidance, and retention in achieving project success (Li, Zhang & Wang, 2023).

Table 5: Combined Regression coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.608	.215		-2.834	.005
	Risk Reduction	.295	.059	.257	4.985	.000
	Risk Transfer	.045	.032	.040	1.394	.165
	Risk Avoidance	.685	.059	.640	11.637	.000
	Risk Retention	.115	.035	.111	3.274	.001

a. Dependent Variable: Timely Completion

Source: Primary data, (2024).

From the Coefficients table above the regression model can be derived as follows:

$$Y = -0.608 + 0.295X_1 + 0.045X_2 + 0.685X_3 + 0.115X_4$$

The table presents the results of a regression analysis with "Timely Completion" as the dependent variable. The unstandardized coefficients indicate the magnitude of the impact of each independent variable on timely completion, while the standardized coefficients (Beta) show the relative strength of these impacts. "Risk Reduction" ($\beta = 0.257$, $p < 0.001$), "Risk Avoidance" ($\beta = 0.640$, $p < 0.001$), and "Risk Retention" ($\beta = 0.111$, p = 0.001) all have statistically significant positive effects on timely completion. In contrast, "Risk Transfer" ($\beta = 0.040$, p = 0.165) is not statistically significant. The constant value is negative, suggesting an overall negative baseline when all independent variables are at zero, though this would depend on the context of the model. These results underscore the varying strengths and directions of influence among the predictors, offering valuable insights into the factors affecting Y (Lee & Kim, 2021).

CONCLUSIONS AND RECOMMENDATIONS
Risk reduction has proven to be a critical factor in ensuring the timely completion of projects. The results consistently show a strong and statistically significant relationship between risk reduction and project deadlines, suggesting that the implementation of effective risk reduction strategies can directly contribute to on-time project delivery. By identifying potential risks early in the project lifecycle and proactively mitigating

them, project managers can prevent delays and enhance project success. This highlights the importance of adopting comprehensive risk management frameworks that emphasize reducing risks to achieve timely project completion.

Although risk transfer is an important risk management strategy, the results of this study suggest that it does not significantly impact the timely completion of projects. The minimal positive coefficient and the lack of statistical significance imply that simply transferring risk to external parties, such as subcontractors or insurers, does not guarantee timely project completion. While transferring certain risks may be necessary for managing larger, unforeseen risks, it appears to have limited influence on meeting deadlines. This suggests that project managers should not rely solely on risk transfer but instead integrate it with other more impactful risk management strategies.

Risk avoidance emerges as one of the most influential factors in ensuring timely project completion. The results reveal a significant positive relationship between risk avoidance and timely completion, indicating that projects that focus on identifying and eliminating potential risks before they arise are more likely to be completed on time. By avoiding known risks and uncertainties, project managers can streamline operations, reduce delays, and maintain project schedules. These findings suggest that risk avoidance should be a central component of project planning and execution, contributing significantly to project success in terms of time management.

Risk retention also plays a role in timely project completion, albeit with a more moderate impact compared to risk avoidance and reduction. The results show that retaining certain risks within the organization can help in maintaining control over project outcomes, though it is less effective in ensuring on-time delivery compared to more proactive strategies. Retaining risks requires careful monitoring and management, as unmanaged risks can lead to delays. Therefore, while risk retention may be necessary in certain contexts, it should be employed alongside other strategies like risk reduction and avoidance to maximize its positive impact on project timelines.

It is recommended that project managers prioritize implementing robust risk reduction strategies to ensure the timely completion of projects. This includes proactively identifying potential risks early in the planning phase and developing strategies to minimize their impact. By reducing the probability and severity of risks, projects are more likely to stay on schedule. Effective risk reduction could involve using technologies that enhance operational efficiency, investing in quality control measures, and conducting regular risk assessments throughout the project lifecycle. Managers should continuously monitor risks and adapt their strategies to mitigate emerging challenges, ensuring timely delivery.

While risk transfer has a minimal direct impact on timely project completion, it is still a relevant tool in managing certain risks. Therefore, it is recommended that risk transfer be used judiciously in cases where external parties are better equipped to handle specific risks, such as financial risks or those related to regulatory compliance. For example, transferring certain operational risks to insurance companies or subcontractors could help mitigate unforeseen disruptions. However, project managers should not rely solely on risk transfer as a strategy to ensure timely completion; instead, it should be combined with other risk management approaches to achieve more effective outcomes.

Given the strong and significant relationship between risk avoidance and timely completion, project managers should prioritize risk avoidance strategies. This can involve modifying project plans to avoid high-risk scenarios, choosing safer technological or methodological approaches, and setting realistic project timelines that factor in potential uncertainties. Risk avoidance should be integrated into the project's overall strategy, with key stakeholders involved in decision-making to ensure that risks are anticipated and effectively avoided. It is essential to continually review project objectives to ensure that they align with risk-averse strategies, which can significantly reduce delays and increase the likelihood of meeting deadlines.

Risk retention can also play a role in ensuring timely project completion, although it should be approached with caution. It is recommended that organizations adopt a balanced approach to risk retention, where risks that are unlikely to significantly impact project timelines or costs are retained, while high-impact risks are mitigated through other strategies. Project managers should clearly assess the potential consequences of retaining risks and ensure that there are contingency plans in place. This may involve setting aside resources or creating flexible schedules to absorb potential disruptions without affecting the overall project timeline. By selectively retaining risks, organizations can manage projects efficiently while keeping risks under control.

Suggestions for Further Studies

Further studies could explore the long-term effects of different risk management strategies on project completion beyond just timeliness. While this study primarily focused on immediate outcomes, investigating how these strategies influence overall project quality, budget adherence, and stakeholder satisfaction over time could provide a more comprehensive understanding of their effectiveness. Additionally, future research might examine how varying project sizes, industries, or geographical contexts impact the relationship between risk management strategies and project outcomes, offering a more nuanced perspective that could help tailor risk management approaches to specific project environments.

Moreover, additional studies could delve into the role of emerging technologies in enhancing risk management practices. Technologies such as artificial intelligence, machine learning, and data analytics have shown promise in predicting and mitigating risks more effectively. Exploring how these technologies can integrate with traditional risk management strategies could provide valuable insights into how project managers can leverage new tools to enhance decision-making and reduce delays. Future research could also consider the impact of organizational culture and leadership on the implementation of these strategies, providing a deeper understanding of how internal factors influence the success of risk management efforts in project completion.

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