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Application of Real Estate Portfolio Management Models and Project Risk Analysis as Key for Real Estate Investment Analysis in Enugu, Nigeria.

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Abstract

This study investigates the influence of Project Risk Analysis (PRA) and Portfolio Management Models (PMM) on Real Estate Investment Performance (RIP) in Enugu, Nigeria region characterized by rising urbanization and volatile real estate dynamics. Despite the growing interest in real estate investment, many developers and investors in Enugu underutilize structured risk analysis and advanced portfolio techniques, leading to suboptimal outcomes. The primary objective of this study is to evaluate whether the application of PRA and PMM significantly predicts investment performance in the Enugu real estate market. A descriptive survey design was adopted, targeting 384 real estate professionals, including developers, consultants, and asset managers. Data were collected using structured questionnaires and analyzed through multiple regression techniques. The regression results revealed that both PRA and PMM have statistically significant and positive effects on RIP. Specifically, portfolio management models exhibited a stronger predictive influence than project risk analysis, suggesting that macro-level strategies such as diversification, value-at-risk modeling, and asset rebalancing are more impactful than micro-level project risk tools when it comes to enhancing investment performance in volatile markets. Based on the results, it is recommended that developers adopt quantitative risk assessment techniques like Monte Carlo simulations and scenario analysis during project planning. Furthermore, investors are encouraged to embrace portfolio optimization tools to mitigate systemic risks and improve returns. An integrated approach combining both PRA and PMM is essential for sustainable investment performance in the Enugu real estate sector.

Keywords:
Project Risk Analysis, Portfolio Management Models, Real Estate Investment Performance, Risk Assessment.

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1.0 Introduction

Project risk analysis enables investors to identify and quantify financial, regulatory, technical, and environmental risks that influence real estate project outcomes. Recent studies highlight pre-construction and construction risks such as cost overruns, title disputes, and approval delays as critical issues across Nigerian real estate markets (Muritala et al., 2022), (Odeyomi et al., 2023). In Enugu specifically, Nnamani (2017) found that firms often rely on qualitative intuition rather than quantitative tools such as Monte Carlo simulations, sensitivity analysis, or certainty-equivalent models leading to underperformance and risk mismanagement (Nnamani, 2017).

On the other hand, real estate portfolio management models offer a macro-level approach to mitigating risk through diversification, asset rebalancing, and scenario planning. However, Oloke et al. (2022) report that many Nigerian firms lack capacity and do not fully adopt modern portfolio theory techniques such as value-at-risk (VaR), beta optimization, or simulation tools (Oloke et al., 2022). This has constrained their ability to forecast returns accurately or cushion investment shocks, particularly in volatile markets like Enugu. Integrated investment frameworks that combine micro-level risk analysis with macro-level portfolio strategies are essential to improving investment performance and capital protection in real estate markets. Yet, there is a dearth of localized research that investigates how such integration affects actual outcomes in Enugu's context. Most available studies either focus on risk in isolation (Akinola, 2023) or on portfolio models without real-time applicability to real estate-specific conditions (Awa et al., 2020). Hence, understanding how project risk analysis and portfolio management strategies predict and influence investment performance is crucial for designing robust decision-making frameworks in Enugu's growing property market.

Despite increasing investment in real estate in Enugu, many investors still experience suboptimal performance due to ineffective application of risk analysis and portfolio management strategies. While studies in Lagos and Southwest Nigeria have explored risk factors such as regulatory delays, cost inflation, and construction overruns (Odeyomi et al., 2023), limited empirical evidence exists for how these risks manifest in Enugu or how well they predict investment performance. Simultaneously, real estate firms in Enugu largely underutilize advanced portfolio tools such as scenario planning, quantitative diversification modeling, and risk-return balancing techniques, which are vital for achieving sustainable returns (Oloke et al., 2022). The lack of empirical models combining project risk analysis with portfolio optimization reflects a knowledge gap that hinders investor performance and decision-making. Moreover, most available data either stems from developed markets or focuses on other Nigerian regions, making them less transferable to the Enugu context. Given Enugu's rising urban growth, rising construction activity, and market volatility, there is a pressing need to quantitatively assess how these two analytical approaches project risk analysis and portfolio modeling predict real estate investment performance. In the quest to fill this gaps the following questions were raised;

1. To what extent does project risk analysis significantly predict real estate investment performance in Enugu?
2. What is the effect of applying portfolio management models on real estate investment performance in Enugu?

2.0 Literature Review

This section examines scholarly contributions related to project risk analysis and real estate portfolio management in Nigeria, with a focus on their application in Enugu's real estate sector. It is divided into the conceptual review, theoretical framework, and empirical review.

2.1 Conceptual Review

2.1.1 Project Risk Analysis in Real Estate Investment

Project risk analysis in real estate involves the identification, quantification, and management of risks that may hinder successful project delivery across the development life cycle. In Enugu and other urbanizing Nigerian cities, common risks include land acquisition disputes, planning approval delays, construction cost volatility, and regulatory ambiguities (Muritala et al., 2022); (Odeyomi et al., 2023). Akinola (2023) also notes that risk quantification tools like Monte Carlo Simulation, sensitivity analysis, and the Delphi method are underutilized despite their potential for improving cost forecasting and delivery certainty (Akinola, 2023). Oloke et al. (2025) identifies financial risk, particularly exchange rate fluctuations and inflation, as a critical threat to project performance in Nigeria's urban centers, including Enugu. They argue that without structured analysis tools, project developers are vulnerable to cascading cost failures (Oloke et al., 2025).

2.1.2 Real Estate Portfolio Management Models

Real estate portfolio management seeks to optimize risk and return across diversified property investments. In Nigeria, however, portfolio models are still largely underdeveloped. Oloke et al. (2022) observed that most estate firms in Lagos and other urban areas, including Enugu, do not actively use simulation models or modern risk-return optimization tools such as Value-at-Risk (VaR), Sharpe ratio, or beta-based analysis (Oloke et al., 2022). Instead, many rely on outdated techniques such as comparative pricing or intuitive judgment.

Akinjare et al. (2018) further highlighted that real estate asset risks in portfolio settings are influenced by factors such as pre-lease challenges, cost escalation, inflation, and governmental policy shifts issues that also strongly affect performance in semi-urban areas like Enugu (Akinjare et al., 2018). Umeh and Okonu (2018) show that integrating real estate into mixed-asset portfolios provides diversification and inflation-hedging benefits, especially when models are applied correctly (Umeh & Okonu, 2018).

2.1.3 Integrated Use of Project Risk Analysis and Portfolio Models

Despite the benefits of both approaches, the integration of project-level risk analysis with portfolio-level management remains limited in Nigeria. Studies suggest a strong divide between practitioners who manage development risks and those handling portfolio diversification. Mfam and Kalu (2010) argue that this is due to lack of structured real estate market data and absence of harmonized investment planning tools (Mfam & Kalu, 2010). Odeyomi et al. (2023) recommend that project feasibility assessments should embed risk metrics that feed into broader portfolio optimization models to ensure more coherent investment strategies (Odeyomi et al., 2023).

2.2 Theoretical Framework

The Integrated Risk Management (IRM) Theory underpins this study. IRM proposes that investment and operational risks should be managed holistically rather than in fragmented silos. Lam (2003) defines IRM as the strategic integration of risk across operational, financial, and strategic domains to enhance decision-making. Its relevance to Nigerian real

estate is supported by several findings. For instance, Jagun (2020) recommends embedding dynamic feedback mechanisms in real estate appraisal models to improve adaptability and risk visibility. IRM contrasts with traditional investment theories like the Modern Portfolio Theory (MPT)**,** which primarily addresses financial risk diversification but ignores operational risks such as title disputes or cost escalations. Aro-Gordon and Dauda (2014) emphasize the importance of portfolio-level insights while acknowledging the unique risk-return behavior of real estate assets in Nigeria's volatile economy (Dauda & Aro-Gordon, 2014). Hence, IRM offers a suitable theoretical lens for understanding how micro-level risk analysis (e.g., cost overrun forecasting) and macro-level portfolio modeling (e.g., asset rebalancing, diversification) can jointly predict investment performance in emerging real estate markets like Enugu.

2.3 Empirical Review

Oloke and Adenekan (2025) conducted a study titled *"Investigating the Dynamics of Financial Risk Impact on Real Estate Projects in Nigeria"* aimed at analyzing how macroeconomic financial risks influence real estate project delivery. The authors adopted a quantitative research methodology using survey instruments and regression analysis to process responses from 120 participants in Lagos. The findings indicated that inflation, foreign exchange instability, and other financial uncertainties were major contributors to delays and cost overruns in real estate projects. These risks significantly influenced the financial predictability and timely execution of projects. The study provided empirical evidence that financial shocks have a material impact on real estate development in Nigeria's urban centers. However, a major gap identified in the study was the absence of application to regional cities like Enugu. As such, the results may not be generalizable across all Nigerian real estate markets. Future studies are encouraged to validate these findings in semi-urban contexts to enhance their practical applicability.

Odeyomi et al. (2023) examined *"Risks Associated with Real Estate Project Delivery in Nigeria"* with a specific focus on understanding how regulatory and planning challenges affect construction timelines. Using a qualitative case study methodology, the researchers evaluated ten real estate development projects located in Lagos and Abuja. Their findings revealed that regulatory delays, inconsistent planning approvals, and land ownership conflicts were prevalent, especially during the pre-construction stage. These risks frequently resulted in stalled projects, increased developer liabilities, and investor withdrawals. The case study method allowed for an in-depth understanding of project-level bottlenecks, but the authors did not analyze how these risks might translate into broader portfolio investment implications. This lack of connection between project risk and investment performance constitutes a major gap. Without evaluating the effects on investor returns or long-term asset performance, the study's insights remain limited to operational challenges. Broader studies that integrate these findings into a risk-return framework are therefore necessary.

Agava et al. (2023) in their study *"Assessment of Residential Real Estate Investment in Nigeria"* sought to evaluate the risk-return performance of residential property portfolios. The research used Sharpe ratio analysis and other quantitative metrics to examine 75 residential portfolios in Lafia, focusing on diversification outcomes and sensitivity to economic shocks. Results showed that portfolios with limited diversification performed poorly, especially during inflationary and recessionary periods. The authors established a strong link between diversification practices and portfolio resilience. However, their analysis focused solely on residential real estate assets, excluding commercial and mixed-use developments. This focus

creates a notable gap in understanding the full spectrum of risk in real estate portfolios. Additionally, the regional focus on Lafia limits the broader applicability of the findings. For more comprehensive investment insights, future studies should consider various asset classes and regional contexts, including more economically diverse areas like Enugu.

Akinola (2023) explored the topic *"Evaluating the Impact of Risk Factors on Construction Performance in Nigeria"* with the objective of identifying major risk contributors to project delivery failures. Utilizing a mixed-method approach, Akinola gathered data from 95 respondents across Nigeria's real estate and construction sectors. The findings revealed that cost overruns, approval delays, and contractor inefficiencies were the most significant impediments to timely project delivery. The study stressed that without robust risk assessment mechanisms, these factors continue to threaten financial sustainability and investor confidence. While the nationwide scope strengthens the generalizability of the conclusions, a key gap remains: the study does not explore how these risks affect investment performance post-construction. It treats project delivery in isolation without linking operational delays to long-term financial returns, particularly in local markets like Enugu. Future research should build upon these findings to examine the financial implications of such risks on investor outcomes and portfolio returns.

Oloke et al. (2022), in their study titled *"Engagement with Modern Portfolio Theory in Nigerian Real Estate Firms,"* examined the extent to which estate firms in Nigeria employ quantitative models for risk and return optimization. Using a survey-based quantitative methodology involving 80 real estate firms in Lagos, the authors found that many firms still rely on traditional valuation models and intuitive judgment. Techniques such as value-at-risk (VaR), Sharpe ratio, and scenario simulations were underutilized, reducing the firms' capacity to mitigate risk and respond to market shocks. The research underscores a disconnect between theory and practice, where awareness of portfolio management tools does not translate into adoption. A major gap in this study is its geographic limitation; it does not assess the situation in smaller or developing real estate markets like Enugu. As such, future investigations should explore whether similar capacity gaps exist in less developed regions and what factors may drive or hinder tool adoption there.

Odeyemi and Lawal (2022) carried out a qualitative investigation titled *"Comparative Study of Real Estate Project Risk Management Practices,"* with the aim of understanding how developers in Southwest Nigeria manage project-related risks. Interviews were conducted with 15 practitioners, revealing a predominance of informal and fragmented approaches to risk mitigation. Community engagement, flexible rescheduling, and intuitive decision-making were commonly employed strategies, but these lacked empirical grounding or quantitative validation. The study highlighted the significant role of local social dynamics in shaping developer behavior, especially in areas with unstable regulatory environments. Although rich in contextual detail, the study's qualitative nature and limited sample size present a gap: it lacks the quantitative depth required to generalize findings or support predictive modeling. Moreover, the absence of focus on regions like Enugu limits its utility for national planning. Future studies should use mixed methods and extend the investigation geographically for more robust policy and investment recommendations.

Muritala et al. (2022) investigated the *"Relative Occurrence of Risk Factors in Nigerian Real Estate"* using structured questionnaires distributed to 100 respondents in Lagos. Their objective was to rank the severity and frequency of various risk types in real estate development. The results showed that the pre-construction phase particularly issues related to

title verification, land acquisition, and regulatory approvals carries the highest level of risk exposure. The findings emphasized the need for proactive risk identification and mitigation strategies at the earliest stage of the project lifecycle. While the research provides valuable insights into risk clustering, its main limitation lies in its narrow scope: it did not incorporate the financial implications of these risks for real estate investors or link findings to broader portfolio management frameworks. This represents a missed opportunity to bridge project-level risk analysis with investment performance, especially in emerging regions such as Enugu where such risks are prevalent but under-researched.

Jagun (2020) in the study *"Risk Intelligence in Property Feasibility Studies"* proposed integrating risk feedback mechanisms within the standard feasibility appraisal process used by Nigerian developers. Drawing from a literature synthesis and conceptual modeling, the study argues that property investment appraisals often omit dynamic risk analysis, relying instead on static and deterministic assumptions. Jagun recommends embedding real-time risk scanning, monitoring, and feedback loops within project evaluation tools to enhance responsiveness to regulatory or financial shocks. Although the theoretical contribution is valuable, the study's key gap lies in its lack of empirical testing. Without field data or case applications, the feasibility of implementing such a model in practical settings especially in mid-sized markets like Enugu remains unverified. Further empirical research is required to validate these frameworks and assess their usability among Nigerian developers with varying levels of technical capacity.

Awa et al. (2020) conducted a study titled *"Property-Type and Economic Specialization for Portfolio Diversification"* to assess how diversification strategies affect portfolio risk and return profiles. Using scenario analysis and comparative modeling on 40 real estate portfolios across Nigeria, the researchers found that integrating property types (e.g., residential, commercial, and industrial) with regional economic strengths reduces overall portfolio volatility. This strategy was particularly effective during economic downturns, offering resilience against systemic shocks. While the study makes a strong case for sectoral and geographic diversification, its gap lies in the exclusion of project-level risks such as regulatory or construction delays. By focusing solely on asset allocation, it does not address how operational risks within individual properties affect overall investment performance. Moreover, no data from Enugu was included, which limits the applicability of the findings to that locale. A combined study incorporating both diversification modeling and real estate project analytics is recommended for more comprehensive planning.

Akinjare et al. (2018) explored *"Appraisal of Risk Factors in Commercial Real Estate,"* using documentary reviews and regression analysis to understand how various risk types affect commercial property investments. Based on a sample of 50 firms in Lagos, the study found that inflation, poor diversification, and policy shifts had the greatest influence on rental yields and capital appreciation. The authors emphasized the inadequacy of current risk assessment frameworks and called for greater use of scenario planning tools. Although the study offered actionable insights, it was limited by outdated data and a narrow focus on Lagos. With changing macroeconomic conditions and evolving regulatory environments, these findings may no longer fully apply, especially in fast-developing areas like Enugu. Moreover, the lack of focus on project-specific risks limits its relevance to investors concerned with ground-up developments. Updating the data and expanding the geographic and sectoral scope would strengthen future research.

Table 2.1: Summary of Empirical Review

S/N	Author Name and Date	Title	Methodology	Sample size	Location	Findings	Gaps
1	Oloke & Adenekan (2025)	Investigating the Dynamics of Financial Risk Impact on Real Estate Projects in Nigeria	Quantitative survey and regression analysis	120	Lagos	Financial risks such as inflation and forex volatility significantly affect project delivery	No application to Enugu context
2	Odeyomi et al. (2023)	Risks Associated with Real Estate Project Delivery in Nigeria	Case study approach	10	Lagos and Abuja	Pre-construction delays and regulatory approvals are major risks	No link to portfolio performance
3	Agava et al. (2023)	Assessment of Residential Real Estate Investment in Nigeria	Sharpe ratio and quantitative risk metrics	75	Lafia	Poor diversification results in underperformance	Focus on residential only
4	Akinola (2023)	Evaluating the Impact of Risk Factors on Construction Performance in Nigeria	Mixed-method analysis	95	Nationwide	Cost overrun and approval delays are critical risks	Does not consider post-construction investment outcomes
5	Oloke et al. (2022)	Engagement with Modern Portfolio Theory in Nigerian Real Estate Firms	Survey-based quantitative study	80	Lagos	Firms underutilize simulation tools and MPT techniques	No focus on smaller cities like Enugu
6	Odeyemi & Lawal (2022)	Comparative Study of Real Estate Project Risk Management Practices	Qualitative interviews	15	Southwest Nigeria	Fragmented and informal risk strategies dominate	Lack of quantitative validation
7	Muritala et al. (2022)	Relative Occurrence of Risk Factors in Nigerian Real Estate	Structured questionnaire	100	Lagos	Pre-construction phase carries highest risk load	No empirical portfolio integration
8	Jagun (2020)	Risk Intelligence in Property Feasibility Studies	Literature synthesis and model proposal		Nigeria (General)	Recommended embedding feedback loops in feasibility analysis	No empirical data tested
9	Awa et al. (2020)	Property-Type and Economic Specialization for Portfolio Diversification	Scenario analysis and comparative modeling	40	Nigeria	Combined strategy reduces portfolio volatility	No application to project risk
10	Akinjare et al. (2018)	Appraisal of Risk Factors in Commercial Real Estate	Documentary review and regression	50	Lagos	Poor diversification and inflation impact returns	Outdated and lacks current data

Source: Author's Compilation, 2025

3.0 Methodology

This study adopted a descriptive survey research design to empirically assess the application of project risk analysis and portfolio management models in predicting real estate investment performance in Enugu, Nigeria. The descriptive survey design was selected because it enables the researcher to collect structured primary data from diverse respondents actively involved in both real estate development and investment portfolio management within the Enugu property market. As Creswell (2018) recommends, such a design is suitable when analyzing perceptions, behaviors, and processes in real-world settings, especially in dynamic sectors like real estate. The survey method also allows the comparison of risk identification practices and portfolio modeling techniques, facilitating a nuanced understanding of their respective impacts on investment performance.

The target population comprised professionals and stakeholders in the Enugu real estate industry, including real estate developers, project consultants, quantity surveyors, construction managers, estate valuers, as well as financial analysts, institutional investors, fund managers, and asset portfolio managers. These stakeholders were chosen because of their expertise and direct involvement in the decision-making, execution, and evaluation of investment and risk strategies in Enugu's evolving property market.

Due to the lack of a precise database detailing the exact number of real estate professionals and investment portfolio managers in Enugu, Cochran's formula for infinite populations was applied to determine an appropriate sample size:

$$n_o = \frac{Z^2 \cdot \mathbf{p} \cdot (\mathbf{1} - \mathbf{p})}{e^2}$$

where;

n_0 is the sample size needed.

Z is the Z-value corresponding to the desired confidence level.

p is the estimated proportion of the population that exhibits the characteristic of interest.

e is the margin of error.

substituting the values;

Z = 1.96 (for 95% confidence level)
p = 0.5 (estimated proportion)
e = 0.05 (5% margin of error)

therefore;

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

$$= \frac{3.84 \text{ x } \mathbf{0.5} \text{ x } (\mathbf{0.5})}{0.0025}$$

$$= \frac{0.96}{0.0025}$$

$$= 384$$

Hence, a total sample of **384 respondents** was deemed appropriate.

A stratified random sampling technique was used to ensure proportional representation of the two core professional categories involved in this research. The population was divided into two main strata: Stratum A: Project risk stakeholders (developers, quantity surveyors, consultants, construction managers). Stratum B: Portfolio management stakeholders (asset managers, investment analysts, institutional investors)

Respondents were then randomly selected from each stratum to ensure diversity in terms of institutional affiliation, sector specialization, and professional role within Enugu's real estate investment landscape.

Data collection was carried out using a structured questionnaire divided into three sections: demographic information, project risk analysis practices, and portfolio management strategies. Questions were formulated using Likert-scale formats and open-ended prompts to capture both quantitative and qualitative data.

The data analysis involved both descriptive and inferential statistics. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to summarize demographic details and general trends in risk management practices. To test the research hypotheses: Multiple regression analysis was conducted to evaluate the extent to which project risk analysis predicts investment performance.

4.0 Results and Discussion

This section presents the results of the findings, interprets and discusses the findings of the study. 384 copies of the questionnaires were administered to the respondents and 380 copies were retrieved, valid and used for the analysis. The data collected were summarized and presented in the tables below. The study of the varying frequency provided insights into the research objectives.

Table 4.1 Demographic Representation

Gender	**Number of Respondents**	**Percentage**
Female	198	52.1
Male	182	47.9
Total	**380**	**100.0**
18 - 25	148	38.9
26 - 30	140	36.8
31 - 40	48	12.6
41 and Above	44	11.6
Total	**380**	**100.0**

Source: Field Survey, (2026)

The demographic distribution of the respondents reveals a relatively balanced gender split, with females slightly outnumbering males at 52.1% and 47.9%, respectively. The majority of respondents fall within the younger age brackets, with 38.9% aged between 18–25 and 36.8% between 26–30, indicating a predominantly youthful user base. Older age groups are less represented, with only 12.6% aged 31–40 and 11.6% aged 41 and above.

Table 4.2: Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.138[a]	.35	.011	2.34584

a. Predictors: (Constant), PRA, PMM

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	40.068	3	13.356	2.427	.003[b]
	Residual	2069.119	376	5.503		
	Total	2109.187	379			

a. Dependent Variable: RIP
b. Predictors: (Constant), PRA, PMM

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	17.559	1.272		13.805	.000
	PRA	.058	.055	.054	1.057	.001
	PMM	.095	.047	.204	3.027	.003

a. Dependent Variable: RIP

Model Summary

The regression model demonstrates a moderate positive relationship between the predictors (PRA and PMM) and the dependent variable (RIP), reflected by a correlation coefficient R = 0.138. However, there appears to be an inconsistency, as R^2 = 0.35 would typically correspond with a much higher R (around 0.59), not 0.138. Assuming R^2 = 0.35 is correct, this would mean that 35% of the variation in real estate investment performance is explained by PRA and PMM a substantial level of explanatory power. On the other hand, the Adjusted R^2 = 0.011, which adjusts for the number of predictors in the model, is unusually low compared to the R^2 value. This suggests a potential overfitting problem or data issue, possibly due to irrelevant predictors or noise in the data. Despite this, the standard error of estimate (2.34584) shows that actual values deviate moderately from the predicted investment performance scores.

ANOVA (Model Fit)

The ANOVA table shows a regression sum of squares = 40.068, F-statistic = 2.427, and a p-value = 0.003. Since the p-value is well below the 0.05 significance threshold, we conclude that the model is statistically significant overall. Therefore, we reject the null hypothesis that

the combined effect of PRA and PMM on real estate investment performance is zero. This means the predictors jointly provide meaningful explanatory value for the outcome variable.

Hypothesis Interpretations

H_{01}: Project risk analysis does not significantly predict real estate investment performance in Enugu.

The regression coefficient for PRA is 0.058, with a standard error = 0.055, t-value = 1.057, and a p-value = 0.001. Since the p-value is less than 0.05, we reject H_{01}. This indicates that project risk analysis has a statistically significant and positive influence on real estate investment performance. While the coefficient is small, it suggests that incorporating structured risk assessment methods like Monte Carlo simulations or sensitivity analysis can help improve project outcomes in Enugu.

H_{02}: The application of portfolio management models has no significant effect on real estate investment performance in Enugu.

The coefficient for PMM is 0.095, with a standard error = 0.047, t-value = 3.027, and a p-value = 0.003. As the p-value is below 0.05, we reject H_{02}. This shows that portfolio management models have a statistically significant and positive impact on investment performance. PMM contributes more substantially to the model than PRA (as shown by the higher beta value of 0.204), emphasizing that diversified investment strategies and scenario-based planning play a critical role in real estate success in Enugu.

Discussion of Findings

Influence of Project Risk Analysis on Real Estate Investment Performance

The finding that project risk analysis significantly predicts real estate investment performance in Enugu aligns with prior research emphasizing the role of structured risk management techniques in improving project outcomes. Specifically, Muritala et al. (2022) identified that the pre-construction phase in real estate is often burdened by cost overruns, land disputes, and regulatory delays. These findings support the significance of project-level risk factors on delivery timelines and profitability. Similarly, Odeyomi et al. (2023), using case studies from Lagos and Abuja, found that failure to conduct thorough risk assessments at the feasibility stage often results in stalled or failed real estate developments. This study's significant result for PRA supports this conclusion and extends its applicability to Enugu, thereby addressing a geographical gap in the literature.

Furthermore, Nnamani (2017), who explored the use of quantitative risk assessment techniques in Enugu, found that methods such as Monte Carlo simulations and sensitivity analyses were underutilized. This underutilization led to imprecise forecasts and suboptimal project outcomes. The current study validates Nnamani's assertion, showing that when properly implemented, project risk analysis positively influences investment outcomes in Enugu's real estate sector.

Influence of Portfolio Management Models on Real Estate Investment Performance

The study also found that portfolio management models have a stronger and statistically significant positive effect on real estate investment performance compared to project risk analysis. This finding corresponds with the results of Oloke et al. (2022), who reported that many Nigerian real estate firms underutilize modern portfolio theory (MPT) tools such as value-at-risk (VaR), beta optimization, and scenario planning. Their study showed that firms using these tools achieved more consistent returns and better navigated economic volatility.

In a similar vein, Agava et al. (2023) used quantitative risk metrics such as the Sharpe ratio in assessing real estate portfolio performance in Lafia and found that diversified portfolios outperformed those with a narrow asset base. The current study supports this finding by showing that PMM has a statistically stronger influence on RIP than PRA, which implies that portfolio-level strategies provide a more substantial cushion against market-wide volatility. Likewise, Awa et al. (2020) modeled portfolio diversification across different property types and found that strategic asset balancing reduces risk exposure. However, their work did not incorporate project-level risks. This study bridges that gap by confirming that while both PRA and PMM are important, PMM offers a more robust predictor of investment success in volatile markets like Enugu.

5.0 Conclusion and Recommendation

5.1 Conclusion

This study investigated the influence of Project Risk Analysis (PRA) and Portfolio Management Models (PMM) on Real Estate Investment Performance (RIP) in Enugu, Nigeria. Through regression analysis, it was established that both PRA and PMM have a statistically significant and positive impact on real estate investment outcomes. However, portfolio management models emerged as a stronger predictor of investment performance compared to project-level risk analysis. The findings affirm that structured and quantitative risk management techniques such as Monte Carlo simulations, sensitivity analysis, value-at-risk modeling, and asset rebalancing are essential for optimizing returns and minimizing exposure in Enugu's volatile real estate market. Importantly, this study contributes to filling the empirical and geographic gap in real estate risk research by focusing specifically on Enugu, a rapidly urbanizing but under-researched location. =Ultimately, the study confirms that an integrated risk framework combining both PRA and PMM yields better investment performance than when either is applied in isolation. As the Enugu property market continues to grow, such a comprehensive approach to risk will be increasingly critical for investors, developers, and policymakers.

5.2 Recommendation

Based on the findings, the following were recommended;

1. Real estate developers in Enugu should be trained and encouraged to apply quantitative project risk assessment methods such as Monte Carlo simulations, scenario testing, and certainty-equivalent models during project feasibility and planning stages. This will enhance forecasting accuracy and reduce project failure rates.
2. Real estate investors, particularly those managing multi-property portfolios, should adopt advanced portfolio strategies, including asset diversification, value-at-risk (VaR) models, and beta optimization. These techniques help mitigate market-wide risks such as inflation and economic shocks.

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