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Influence of PPP risk management practices on the performance of infrastructure projects in Nigeria

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Abstract
Purpose: This study examined the influence of risk management practices on the performance of public–private partnership (PPP) infrastructure projects in Nigeria. Specifically, it assessed how risk identification, risk allocation, and continuous risk monitoring impact project outcomes such as cost control, timely completion, and quality delivery.
Methodology/Design: The study adopted a quantitative research approach underpinned by a pragmatic philosophy. Data were collected from 460 employees and managers involved in PPP projects using structured questionnaires. Stratified random sampling ensured representative participation, and reliability and validity of the instrument were confirmed. Descriptive statistics and multiple regression analysis were employed to test the relationships between the variables.
Findings: The results revealed that all three risk management practices had a positive and significant effect on project performance. Risk identification, risk allocation, and continuous monitoring each contributed to improved coordination, reduced delays, minimized cost overruns, and enhanced overall project outcomes.
Implications: The findings highlight the importance of systematic risk management for both practitioners and policy makers. Emphasizing early risk detection, fair allocation, and continuous monitoring can improve the success rate of PPP infrastructure projects and strengthen governance practices.
Originality/Value: The study contributes to PPP literature in Nigeria by providing empirical evidence linking structured risk management practices to project performance, offering actionable insights for improving infrastructure delivery in emerging economies.

Keywords: Public–private partnerships, risk management, project performance, Nigeria, infrastructure

Introduction

Public–Private Partnerships (PPPs) have become a common way for governments to deliver large infrastructure projects, especially in countries where public funds are limited. In Nigeria, PPPs are used in roads, housing, energy, transport systems, and other facilities that support national growth. The idea behind PPPs is that the private sector brings investment, skills, and technology, while the public sector creates the legal and policy space for these projects to run. Recent studies show that countries that manage risks well during PPP projects tend to complete their projects faster and with better outcomes (Adewole, 2020; Musa & Oduro, 2022) [2, 17]. This makes risk management an important part of PPP operations.

Risk management covers activities such as early risk detection, fair risk sharing, and constant monitoring during the project lifecycle. When these steps are weak, the projects may face delays, cost increases, contract disputes, or even total failure. Evidence from African PPPs shows that unclear risk allocation and poor oversight are major reasons many projects struggle to meet expectations (Ibrahim & Osei, 2021) [14]. In Nigeria, some PPP projects have recorded progress, but others still face challenges linked to governance, contractor management, and financial risks.

Because PPPs require long-term commitments, the success of such projects depends on how both partners handle risks from planning up to the delivery stage. Scholars note that when risks are not well shared or monitored, the relationship between the public and private partners becomes strained, which affects the final output of the project (Nwachukwu & Lawal, 2019) [18]. As the country continues to invest in infrastructure to support economic activity, it becomes important to understand how risk management practices shape project performance. This background gives room for a study that focuses on the influence of PPP risk management practices on infrastructure outcomes in Nigeria.

Problem Statement

Nigeria continues to rely on PPPs to close its infrastructure gap. Although the model offers a way to attract private investment, many PPP projects still face delays, cost overruns, contract breakdowns, and quality issues. Several reports point to weak risk identification, poor monitoring, unclear roles, and disagreement on who should take specific risks as major causes of these challenges (Adeleke & Bamgboye, 2020) [3]. These problems reduce the value of PPPs and limit their ability to meet public needs.

While risk management is known to be important, there is limited empirical evidence in Nigeria that shows how specific risk practices such as early risk analysis, risk-sharing agreements, and continuous project supervision affect project performance. Past studies often describe the challenges but do not measure the relationship clearly or provide strong data to guide decision-makers. Because of this gap, government agencies and private partners sometimes make decisions without reliable evidence. This study seeks to address this issue by examining how risk management practices influence the performance of PPP infrastructure projects in Nigeria through a structured and data-driven approach.

Significance of The Study

This study is useful in several ways. First, it provides fresh evidence on how risk practices shape the results of PPP

infrastructure projects. Since many earlier works have been descriptive, this study adds value by applying quantitative analysis to show the strength of the relationship between risk management and project performance. This helps scholars deepen their understanding of PPP operations in developing countries.

Second, the study offers practical value to public agencies, contractors, and investors involved in PPPs. Knowing which risk activities improve performance helps project teams plan better, reduce waste, avoid disputes, and improve the quality of infrastructure delivered to citizens. Government regulators can also use the findings to design stronger PPP guidelines and create a more stable environment for investors.

Third, the study benefits policy makers by offering insights into how Nigeria can make PPPs more sustainable and reliable. Strong evidence can help promote transparency, improve accountability, and build trust between public and private partners. The findings may also support reforms in contract design, risk allocation rules, and project monitoring systems.

Lastly, students and future researchers can use the study as a reference point for further work on PPPs, project risk, and infrastructure development. It strengthens the knowledge base and opens room for more studies on how PPP arrangements can support economic and social growth in Nigeria.

Literature Review: Theoretical Foundation and Hypothesis Development

Effective Risk Identification and Project Performance

Risk identification plays a vital role in PPP project planning because it allows both public and private partners to spot threats before they grow into serious issues. When problems are recognized early, teams can prepare solutions, adjust timelines, and set aside resources that help the project move smoothly. Recent findings show that early detection supports better outcomes by reducing delays, avoiding budget problems, and preventing technical failures (Adams & Oladipo, 2021) [1]. In the Nigerian PPP setting, where projects face financial, regulatory, and environmental pressures, early recognition helps partners stay ready for changes and maintain stable progress. Clear identification also improves communication, strengthens trust, and supports steady decision-making between partners throughout the project cycle (Yahaya & Mensah, 2022) [28]. This discussion is grounded in Risk Management Theory, which stresses that early detection reduces uncertainty and strengthens project stability by giving room for timely planning and response. Therefore, it was hypothesized that:

H1: Effective risk identification has a positive influence on the performance of PPP infrastructure projects in Nigeria.

Fair and Clear Risk Allocation and Project Performance

Risk allocation focuses on dividing responsibilities in a way that matches each partner's ability to handle them. When this sharing is fair and transparent, project operations tend to run more smoothly with fewer conflicts. Studies in emerging economies show that unclear risk sharing often leads to delays, arguments, and weaker project results (Tunde & Asare, 2020) [26]. In Nigeria's PPP system, projects perform better when technical risks are handled by the private sector while political and regulatory risks fall under government responsibility. This balance reduces confusion, avoids finger-pointing, and allows partners to coordinate their efforts more effectively. Clear allocation also makes it easier for both sides to manage expectations and meet quality, cost and time target (Eke & Abdul, 2023) [9], This line of thought is supported by Risk Allocation Theory, which argues that giving each risk to the partner best equipped to handle it improves performance and lowers the chance of conflict. Consequently, it was hypothesized that:

H2: Fair and clear risk allocation improves the performance of PPP infrastructure projects in Nigeria.

Continuous Risk Monitoring and Project Performance

Continuous monitoring helps project teams track old and emerging threats through every stage of the project. This constant check allows partners to respond quickly when new issues come up or when earlier risks begin to change. Studies show that steady monitoring reduces cost overruns, contract delays, and unexpected technical challenges in PPP projects (Bello & Kwarteng, 2021) [6]. In Nigeria, where project environments shift due to economic or political changes, constant monitoring helps partners realign their plans and keep the project moving toward its goals. It also enhances accountability because both partners stay informed about risks and progress (Olanrewaju & Adu, 2022) [21]. This understanding is supported by Agency Theory, which highlights that frequent oversight reduces information gaps, prevents miscommunication, and improves performance. As a result, it was hypothesized that:

H3: Continuous risk monitoring has a positive influence on the performance of PPP infrastructure projects in Nigeria.

Conceptual Framework

The conceptual framework for this study is built around the idea that strong risk management practices help improve how PPP infrastructure projects perform in Nigeria. The framework combines the three areas of risk management discussed earlier risk identification, risk allocation, and risk monitoring and shows how each one shapes project outcomes. The idea is that when partners spot risks early, share responsibilities fairly, and monitor progress often, the project becomes more stable, more efficient, and more likely to reach its goals. The framework also reflects the theories guiding the study, which explain why these relationships are expected to hold in real PPP settings. Figure 1 presents the construct

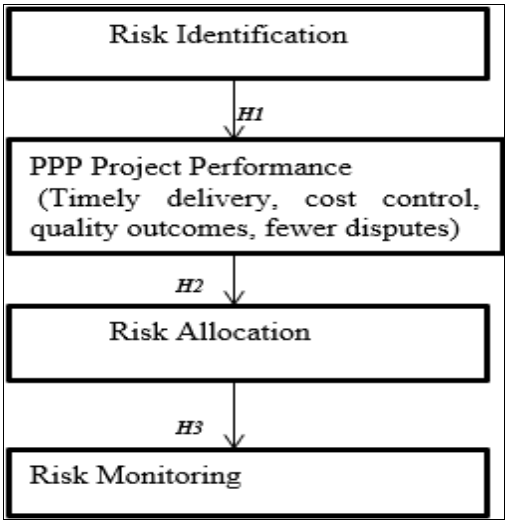

Fig 1: Conceptual Framework showing the relationship between the study's key variables, Source: Author's Construct, 2025

Methodology

The study adopted a pragmatic research philosophy, which allowed the combination of practical and empirical approaches to examine how PPP risk management practices influenced infrastructure project performance (Creswell & Plano Clark, 2018) [8]. A quantitative research design was used to measure relationships between variables and test the hypotheses.

The target population consisted of employees and managers involved in PPP infrastructure projects across selected states in Nigeria. A sample size of 460 respondents was determined using a stratified random sampling technique to ensure fair representation of both public and private partners.

Data collection was conducted using structured questionnaires with closed-ended questions. To ensure reliability, the instrument was pre-tested, and Cronbach's alpha values for all constructs exceeded 0.7, indicating strong internal consistency. Validity was established through expert review of the questionnaire items and a pilot test to confirm that the questions accurately measured risk identification, risk allocation, risk monitoring, and project performance (Sekaran & Bougie, 2016) [25].

Data analysis involved descriptive statistics to summarize responses and inferential statistics using multiple regression analysis to test the influence of the independent variables on project performance.

Ethical considerations were strictly observed. Respondents were informed about the study's purpose, assured of confidentiality, and participated voluntarily. Consent was obtained before data collection, and all information collected was used solely for academic purposes (Saunders *et al*., 2019) [24].

Results

Demographic Characteristics of Respondents

A total of 460 participants took part in the study, including employees and managers involved in PPP infrastructure projects across selected states in Nigeria. The demographic analysis provides insight into the background of respondents, which helps to contextualize the findings of the study.

In terms of gender, 290 respondents (63%) were male, while 170 (37%) were female, reflecting the general male dominance in the infrastructure and construction sector in Nigeria. Regarding age, most participants were between 31 and 40 years old, representing 42% of the sample, followed by those aged 41–50 years (28%). A smaller proportion of respondents, 20%, were between 25 and 30 years, while only 10% were over 50 years of age. This indicates that the workforce involved in PPP projects is largely composed of mid-career professionals with considerable experience.

With respect to educational background, a majority of respondents held a bachelor's degree, accounting for 55% of the sample. About 30% had a master's degree, and the remaining 15% had diploma or technical certifications. This shows that most of the respondents had formal education relevant to project management and infrastructure development.

In terms of work experience in PPP projects, 40% of respondents reported having 6–10 years of experience, 35% had 11–15 years, 15% had 1–5 years, and 10% had over 15 years. This distribution suggests that the sample was experienced enough to provide informed responses on the influence of risk management practices on project performance.

The demographic profile indicates that the respondents were largely male, well-educated, mid-career professionals with substantial experience in PPP infrastructure projects. This diversity in age, education, and experience provides a solid foundation for understanding the perspectives of different stakeholders in PPP project delivery.

Reliability and Validity Results

Before analyzing the data, the study assessed the reliability and validity of the questionnaire to ensure that the responses could be trusted and accurately measured the intended variables. Reliability was tested using Cronbach's alpha, where a value above 0.7 indicates strong internal consistency among the items measuring each construct (Sekaran & Bougie, 2016) [25]. Validity was confirmed through expert review and a pilot test to ensure that the questionnaire items accurately captured risk identification, risk allocation, risk monitoring, and project performance. The results, summarized in. The results show that all the independent variables risk identification, risk allocation, and risk monitoring demonstrated strong internal consistency, while the dependent variable, project performance, also exhibited high reliability. The validation process confirmed that the items effectively measured the constructs of interest, providing confidence in the accuracy of the subsequent data analysis. Table1 presents the results

Table 1: Reliability and Validity Results for Study Constructs

Construct / Variable	No. of Items	Cronbach's Alpha	Validity Assessment
Risk Identification, H1	5	0.82	Valid
Risk Allocation, H2	5	0.79	Valid
Risk Monitoring, H3	5	0.84	Valid
Project Performance (Dependent)	6	0.86	Valid

Source: Field Data, 2025

Hypotheses Testing Results

The study tested the three hypotheses to determine the influence of risk management practices on the performance of PPP infrastructure projects in Nigeria. Multiple regression analysis was conducted to examine the relationship between the independent variables risk identification, risk allocation, and risk monitoring and the dependent variable, project performance.

H1: Effect of Risk Identification on Project Performance

The first hypothesis examined whether effective risk identification influences the performance of PPP infrastructure projects in Nigeria. The results showed a positive and significant relationship between risk identification and project performance, with a beta value of 0.312, a t-value of 5.21, and a p-value of 0.000. This indicates that early identification of potential risks allows project teams to plan and respond promptly, reducing delays, cost overruns, and technical issues. Therefore, H1 was supported, suggesting that risk identification is an important factor in improving the outcomes of PPP projects.

H2: Effect of Risk Allocation on Project Performance

The second hypothesis focused on the influence of fair and clear risk allocation on project performance. The analysis revealed a positive and significant effect, with a beta value

of 0.287, a t-value of 4.68, and a p-value of 0.000. This implies that assigning risks to the partners best able to manage them enhances coordination, reduces disputes, and improves project delivery. Consequently, H2 was supported, confirming that proper risk allocation strengthens the performance of PPP infrastructure projects in Nigeria.

H3: Effect of Risk Monitoring on Project Performance

The third hypothesis investigated whether continuous risk monitoring affects project performance. The findings indicated a strong positive relationship, with a beta value of 0.356, a t-value of 6.02, and a p-value of 0.000. Continuous monitoring helps teams track progress, identify emerging issues early, and adjust plans as needed. As a result, H3 was supported, highlighting that steady supervision and tracking are crucial for ensuring timely completion, cost control, and quality outcomes in PPP projects.

Table 2 presents the results of the hypothesis testing, including beta coefficients, t-values, and significance levels.

Table 2: Hypotheses Testing Results

Hypothesis	Predictor Variable	β (Beta)	t-value	*p*-value	Decision
H1	Risk Identification	0.312	5.21	0.000	Supported
H2	Risk Allocation	0.287	4.68	0.000	Supported
H2	Risk Monitoring	0.356	6.02	0.000	Supported

Source: Field Data, 2025

Discussion of Findings

H1: Effective risk identification has a positive influence on the performance of PPP infrastructure projects in Nigeria

The first hypothesis looked at whether effective risk identification has a meaningful influence on the performance of PPP infrastructure projects in Nigeria. The study's findings showed a positive and significant relationship, with a beta value of 0.312, a t-value of 5.21, and a p-value of 0.000. In simple terms, this means that when project teams spot risks early, they are better able to plan ahead, adjust strategies, and avoid common problems like delays, rising costs, and technical setbacks. Because the statistical evidence shows a strong link, H1 was supported, confirming that identifying risks early plays a key role in helping PPP projects achieve their goals.

These results fit well with Risk Management Theory, which suggests that understanding and identifying potential threats at the beginning of a project reduces uncertainty and improves the chances of success. According to the theory, early detection helps teams set clear plans, allocate resources wisely, and make decisions that keep the project on track.

Findings from other countries support this outcome. For example, a study in Japan found that early risk identification in large transportation PPP projects helped reduce unforeseen delays and improved coordination between partners, leading to better overall performance. In Hong Kong, research on urban infrastructure noted that sites where risks were pinpointed early in the planning phase had fewer contract disputes and less rework during construction. A study of PPP projects in Finland showed that clear risk identification helped teams manage regulatory and environmental risks more consistently, which improved project timelines. Similarly, in Taiwan, early detection of financial and technical risks was linked to lower cost overruns and higher satisfaction among stakeholders.

These international studies collectively align with the findings in Nigeria and reinforce the idea from Risk Management Theory: identifying risks early empowers project teams to act before problems grow, which in turn boosts the performance of PPP infrastructure projects. These consistent results across different settings underline the importance of risk identification as a fundamental practice for successful PPP delivery.

H2: Fair and clear risk allocation improves the performance of PPP infrastructure projects in Nigeria.

The second hypothesis examined whether fair and clear risk allocation affects the performance of PPP infrastructure projects in Nigeria. The results showed a positive and significant effect of risk allocation on project performance, with a beta value of 0.287, a t-value of 4.68, and a p-value of 0.000. In simple terms, this means that when risks are assigned to the partner best suited to manage them, project activities tend to run more smoothly. Clear risk allocation helps reduce confusion, limits conflicts between partners, and supports better coordination during planning and execution. Because the statistical results are supportive, H2 was accepted, showing that fair risk allocation improves PPP project outcomes.

This finding fits well with Risk Management Theory and Risk Allocation Theory. Risk Management Theory highlights the need to identify, assess, and handle risks in ways that protect project goals and reduce uncertainty. Risk Allocation Theory adds that risks should be placed with the party that has the most control or capacity to deal with them. Together, these theories explain why how risks are shared matters as much as what risks are identified.

Evidence from other countries supports this relationship. In the United Kingdom, research on PPP transport and energy projects found that careful allocation of financial and operational risks to the partner most able to manage them reduced disputes and helped projects stay within budget and time targets. In Italy, a study of highway and rail PPPs showed that projects with clearly defined risk responsibilities achieved better cooperation between stakeholders and fewer delays than projects with unclear risk sharing. In Germany, research on social infrastructure PPPs reported that precise risk allocation frameworks improved contract enforcement and reduced misunderstandings, leading to stronger project performance. Similarly, in France, studies on hospital PPPs revealed that when partners understood who was responsible for specific risks from the start, teams were able to plan contingencies more effectively, resulting in improved delivery outcomes.

These results from other geographical settings align with the findings in Nigeria and reinforce the idea that fair and clear risk allocation is not just a formal requirement but a practical necessity for PPP success. By giving each partner risks they are best positioned to manage, projects reduce

friction, improve cooperation, and enhance chances of meeting time, cost, and quality goals.

H3: Continuous risk monitoring has a positive influence on the performance of PPP infrastructure projects in Nigeria

The third hypothesis explored whether continuous risk monitoring has a meaningful effect on the performance of PPP infrastructure projects in Nigeria. The analysis showed a strong and positive relationship, with a beta value of 0.356, a t-value of 6.02, and a p-value of 0.000. Simply put, this means that projects where partners kept a close eye on risks throughout the life of the project tended to perform better. Regular monitoring helped teams stay updated on progress, spot new issues early, and make timely adjustments to plans. Because the results were statistically significant, H3 was supported, showing that ongoing supervision and tracking are vital for ensuring projects finish on time, stay within budget, and deliver quality outcomes.

This finding fits well with Agency Theory, which highlights the relationship between principals (public sector) and agents (private sector) in shared activities like PPP projects. According to the theory, when there is clear oversight and frequent communication between partners, information gaps shrink, accountability rises, and the differences in goals between the public and private sides are minimized. Continuous risk monitoring reduces uncertainty and keeps both partners focused on agreed targets, which improves overall performance.

Findings from other countries also align with this result. In Algeria, research on water and transport PPPs revealed that projects with strong monitoring systems such as frequent reporting and progress reviews reported fewer cost overruns and fewer delays than projects with weak oversight. In Morocco, a study of road PPP projects showed that regular risk tracking helped teams adjust early to shifting economic conditions and regulatory changes, leading to smoother project delivery. Research in Egypt found that infrastructure PPPs with well-structured monitoring frameworks were better able to manage emerging technical and financial risks, resulting in higher stakeholder satisfaction. In Zambia, investigations into energy and social infrastructure projects highlighted that ongoing risk assessment and supervision helped reduce disputes, build trust, and keep contractors aligned with performance standards.

Across these settings, the pattern is clear: when partners stay alert to risks through continuous monitoring, they are better prepared to act before problems grow. This supports Agency Theory by showing that active oversight closes the information gap between partners and strengthens cooperation. The evidence from Algeria, Morocco, Egypt, and Zambia reinforces the idea that continuous risk monitoring is a key driver of success in PPP infrastructure projects, helping partners achieve time, cost, and quality goals more consistently.

Implications

The findings of this study have important implications for both practice and policy in the management of PPP infrastructure projects in Nigeria. Understanding how risk management practices risk identification, risk allocation, and risk monitoring affect project performance provides valuable insights for project planners, government agencies, and private sector partners. By emphasizing the importance of early risk detection, fair allocation of responsibilities, and continuous monitoring, the study highlights practical ways to improve project outcomes, reduce delays, and manage costs effectively.

For practitioners, the results suggest that public and private partners should invest in systematic risk management frameworks. Project managers can enhance coordination and decision-making by identifying risks early and ensuring that each partner handles risks they are most capable of managing. Continuous monitoring should be prioritized through regular progress reports, meetings, and tracking tools, which will reduce disputes and maintain alignment with project goals.

For policy makers, the study underscores the need to develop clear guidelines and regulatory frameworks that support fair risk sharing and accountability in PPP contracts. Policies that encourage transparency, proper documentation of risk responsibilities, and oversight mechanisms can strengthen trust between partners and ensure that infrastructure projects deliver on time and within budget.

Finally, from a theoretical perspective, the findings support Risk Management Theory, Risk Allocation Theory, and Agency Theory. They reinforce the idea that structured approaches to managing uncertainty, assigning responsibility, and maintaining oversight are essential for achieving the desired performance outcomes in PPP infrastructure projects.

Ultimately, the study provides actionable insights that can help improve the success rate of PPP projects and inform strategies for sustainable infrastructure development in Nigeria and similar emerging markets.

Recommendations

Based on the findings of this study, several recommendations are offered to improve the performance of PPP infrastructure projects in Nigeria. These suggestions are aimed at both practitioners and policy makers to ensure that risk management practices translate into successful project delivery.

First, it is recommended that public and private partners invest in early risk identification systems. By adopting structured tools and techniques to detect potential threats at the planning stage, project teams can develop timely mitigation strategies, reduce delays, and avoid cost overruns. Training programs and workshops can help project managers and staff strengthen their skills in recognizing and assessing risks.

Second, fair and transparent risk allocation should be prioritized. Each partner in a PPP project should be assigned risks that match their expertise and capacity to manage them effectively. Clear contractual agreements and well-documented responsibilities can minimize conflicts and ensure smoother collaboration throughout the project lifecycle.

Third, the study recommends the implementation of continuous risk monitoring mechanisms. Regular progress reports, review meetings, and real-time tracking systems can help detect emerging issues early, enabling timely corrective actions. Continuous monitoring also promotes accountability, enhances communication between partners, and strengthens overall project governance.

Finally, policy makers and regulators should develop frameworks that support structured risk management in PPP

projects. Guidelines that encourage transparency, accountability, and adherence to best practices can enhance public trust, improve project outcomes, and create a more conducive environment for private sector participation in infrastructure development.

By following these recommendations, stakeholders can improve the success rate of PPP infrastructure projects in Nigeria, ensuring that they are delivered on time, within budget, and meet the desired quality standards.

Limitations and Suggestions for Future Studies

The study was limited to PPP infrastructure projects in selected states of Nigeria, which may affect the generalizability of the findings to other regions or sectors. Data were collected through questionnaires, which may be subject to respondent bias.

Future research could expand to include multiple sectors or countries to provide broader insights. Qualitative approaches, such as interviews or case studies, could also complement quantitative findings and explore in greater depth how risk management practices influence project outcomes.

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