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“The impact of risk management on the performance of construction projects”

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Abstract:

This study examines the influence of risk management on construction project performance, highlighting the essential function of organized risk management methods in improving project results. The research examines diverse risk management strategies, such as qualitative, quantitative, integrated, and agile approaches, and evaluates their efficacy in budget control, stakeholder satisfaction, and compliance with project timelines. Data was gathered via surveys and interviews with construction experts, and the results indicate that good risk management substantially mitigates financial risks, reduces delays, and enhances overall project quality. The study emphasizes prevalent hazards encountered in construction projects, including financial uncertainties, labor shortages, supply chain interruptions, safety issues, and unexpected delays, along with methods for their mitigation via proactive risk management measures. The findings demonstrate that firms utilizing comprehensive risk management frameworks are more likely to attain project success and improve stakeholder satisfaction.

Keywords: Risk management, construction projects, financial risks, labor risks, project performance, cost control.

المستخلص:

تدرس هذه الدراسة تأثير إدارة المخاطر على أداء مشاريع البناء، وتسلط الضوء على الوظيفة الأساسية لأساليب إدارة المخاطر المنظمة في تحسين نتائج المشروع. ويدرس البحث استراتيجيات متنوعة لإدارة المخاطر، مثل المناهج النوعية والكمية والمتكاملة والرشيقة، ويقيم فعاليتها في التحكم في الميزانية، ورضا أصحاب المصلحة، والامتثال للجداول الزمنية للمشروع. تم جمع البيانات من خلال استطلاعات الرأي والمقابلات مع خبراء البناء، وتشير النتائج إلى أن إدارة المخاطر الجيدة تخفف بشكل كبير من المخاطر المالية، وتقلل من التأخيرات، وتعزز جودة المشروع بشكل عام. وتؤكد الدراسة على المخاطر السائدة التي تواجهها مشاريع البناء، بما في ذلك عدم اليقين المالي، ونقص العمالة، وانقطاعات سلسلة التوريد، وقضايا السلامة، والتأخيرات غير المتوقعة، إلى جانب طرق التخفيف منها من خلال تدابير إدارة المخاطر الاستباقية. وتوضح النتائج أن الشركات التي تستخدم أطر إدارة المخاطر الشاملة من المرجح أن تحقق نجاح المشروع وتحسن رضا أصحاب المصلحة.

الكلمات الرئيسية: إدارة المخاطر، مشاريع البناء، المخاطر المالية، مخاطر العمالة، أداء المشروع، التحكم في التكاليف.

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Introduction:

The construction industry is fundamental to the prosperity of contemporary nations. The rapid economic expansion has heightened the need for infrastructure and facility construction worldwide. The construction industry establishes the fundamental living circumstances essential for the sustainability and advancement of human life on Earth. To address a burgeoning population, land constraints, and escalating economic activity, there is a rising need for construction projects, resulting in a boom in many countries. Construction industry is essential in influencing the physical environment and significantly contributes to the world economy, employing millions and earning considerable money (Omotayo, et al. 2024).

Construction projects are inherently complicated and multidimensional, typically involving several stakeholders such as architects, engineers, contractors, subcontractors, and regulatory agencies. The complexity is exacerbated by reasons like variable market conditions, technological progress, and changing legislation, which can affect project execution and results. The construction sector is marked by uncertainties and hazards that can affect the cost, timeline, quality, and safety of projects. Consequently, these hazards must be discovered, assessed, and meticulously managed according to the information accessible at this juncture (Bahamid, et al. 2022).

Effective risk management involves the systematic identification, assessment, and mitigation of uncertainties to reduce or eliminate undesirable outcomes (Yaseen et al., 2020). This objective may be realized by initiating the risk management process from the outset of a project's life cycle, therefore including the involvement of all stakeholders in this process. In the project's first phase, the related risks stem from uncertainties that constrain decision-making based on prior initiatives. This uncertainty can be characterized as a condition devoid of information. The use of various risk mitigation measures, including risk transfer, acceptance, or avoidance, can influence the project's dynamics, financial stability, and stakeholder satisfaction levels. Understanding the correlation between project performance and risk management is essential for optimizing processes and guaranteeing effective project delivery (George, 2020).

This study seeks to analyze the influence of risk management on the efficacy of building projects. This research will examine several risk management strategies and their implementation in the construction sector, focusing on how effective risk management may enhance key performance indicators, including project schedules, cost control, safety, and quality. This research will offer significant insights for project managers, engineers, and stakeholders in the construction sector, emphasizing the essential function of risk management in achieving project success and tackling the obstacles inherent in complex construction projects.

Problem Statement:

The construction sector is marked by inherent difficulties and uncertainties, resulting in several projects experiencing delays, cost overruns, and inferior quality outputs. Notwithstanding progress in project management approaches and technology, numerous construction projects continue to falter in meeting their objectives, mostly owing to insufficient risk management procedures.

The lack of a systematic method for recognizing, evaluating, and managing risks may lead to unexpected issues that adversely affect project performance. A deficiency in efficient risk management may result in resource misallocation, inadequate communication among stakeholders, and increased susceptibility to external influences such as regulatory alterations and market fluctuations. Consequently, building projects may encounter reduced efficiency, heightened expenses, and impaired safety, eventually impacting their overall performance.

While current literature acknowledges the significance of risk management in enhancing project performance, there is a paucity of empirical research that has rigorously investigated the direct correlation between systematic risk management techniques and distinct quantitative outcomes in construction projects. This study examines the impact of various risk management techniques on essential performance measures within the construction industry. The research is to provide data-driven insights that will aid in the formulation of best practices, allowing stakeholders to improve their risk management procedures and attain more favorable project results.

Study Objectives:

The primary objective of this study is to evaluate the influence of structured risk management practices on the performance of construction projects.

1. To determine the most common risks faced by construction projects, and how they impact project performance in terms of cost, time, and quality.
2. To compare the different approaches of risk management in construction projects toidentify their effectiveness in controlling the budget, meeting the needs of the stakeholders, and adhering to the schedule.
3. To clarify the main challenges or barriers to implementing effective risk management strategies in construction projects.

Study Significance:

This study is significant for its potential to improve knowledge and practices of risk management in the construction sector. This research seeks to identify particular hazards impacting construction projects and evaluate the efficacy of diverse risk management solutions to yield actionable insights for enhanced project results. Improving performance regarding cost, time, quality, and safety is crucial for stakeholders, since proficient risk management is integral to attaining these fundamental objectives. The results are anticipated to substantially enhance the knowledge base in project management, providing evidence-based suggestions that can directly affect the success rates of building projects.

This study will inform the establishment of industry best practices. This research will elucidate the correlation between organized risk management procedures and key performance metrics, therefore showcasing effective risk management strategies and their advantages. This may be a great resource for industry experts aiming to enhance their risk management procedures, resulting in a more efficient building environment. Moreover, by educating stakeholders on the significance of cooperation in risk management, the study will elucidate how good communication and coordination across project teams may promote a proactive strategy for controlling risks.

This research aims to address knowledge gaps in empirical studies about the influence of risk management on building project performance. By emphasizing practical applications and quantifiable results, it will enhance academic literature and establish a basis for further research in this domain. The results may help encourage sustainable practices within the building sector. Efficient risk management mitigates waste, decreases rework, and improves safety, aligning with industry trends toward environmental stewardship and social responsibility.

Ultimately, the insights derived from this study can assist policymakers and industry regulators in formulating recommendations and standards that promote effective risk management techniques in construction. This can eventually enhance safety, efficiency, and sustainability in the building environment. This study's relevance transcends academic research; it seeks to offer practical answers and insights that help improve construction project performance and foster sustainable industry growth.

Limitations of the study:

- Data Availability and Reliability: Obtaining complete and precise data on construction projects, especially about risk management methods and performance measures, can be difficult. Organizations may hesitate to provide confidential information, thereby constraining the thoroughness of analysis. Self-reported data obtained from surveys or interviews may potentially add bias.
- Variability in Project Types: Various categories of construction projects (e.g., residential, commercial, or infrastructure) may face distinct risks and require specific management solutions. This diversity might hinder the analysis and interpretation of outcomes, since findings may not be universally relevant across all project types.
- Dynamic Nature of the Construction Industry: Accelerated technological improvements, regulatory modifications, and shifting market dynamics can influence risk management strategies and project outcomes over time. The study's conclusions may diminish in relevance if new hazards arise and current treatments develop.

- Focus on Quantitative Metrics: The research may predominantly focus on quantitative measures for project performance, potentially neglecting qualitative factors such as stakeholder satisfaction, team dynamics, and corporate culture, which are equally essential for project success.

Definition of key terms:

1. **Risk Management:**

Risk management is a systematic method for discovering, assessing, and mitigating possible hazards to a project's success. In construction, risks may arise from diverse causes including environmental circumstances, financial uncertainty, design flaws, legal complications, and safety hazards. Effective risk management is evaluating the likelihood and consequences of risks, followed by the implementation of solutions such as avoidance, mitigation, or transfer to diminish their adverse effects. Consequently, construction managers can enhance decision-making and secure superior project results (Rashid, 2023).

2. **Construction Project Performance:**

Construction project performance denotes the extent to which a construction project fulfills its designated objectives, commonly assessed by critical indicators such as cost, schedule, and quality. It assesses the efficiency and effectiveness of resource utilization, including personnel, materials, and equipment, in project completion. Performance evaluations also take into account safety events, adherence to regulatory standards, and client happiness. High-performing projects achieve their results under budget and on time, with minimal revisions and a superior quality of the final product (Assaad, et al.2020).

3. **Uncertainty:**

Uncertainty denotes the absence of exact knowledge regarding future occurrences, which can impact the design and implementation of building projects. In contrast to risks, which can be identified and measured, uncertainties are more unpredictable and challenging to measure. They stem from several variables like erratic weather patterns, market price volatility, governmental or regulatory alterations, and unexpected site conditions. Effectively managing uncertainty necessitates adaptable planning and contingency strategies to respond to unforeseen events while maintaining project objectives.

4. **Mitigation Strategies:**

Mitigation methods are measures implemented to diminish the probability or consequences of recognized hazards in a building project. Strategies may encompass diversifying suppliers to mitigate delays, allocating contingency money to manage cost overruns, or instituting stringent health and safety measures to minimize accident risks. Alternative strategies may include restructuring project plans to remove hazardous elements or mitigating risks via insurance or contractual arrangements. Effective mitigation tactics prevent hazards from obstructing the project and facilitate more seamless project execution (Ahmed, 2017).

Literature Review:

1. **Risk Management Process:**

The risk management process establishes the basis for identifying and addressing dangers in project activities. An effective execution of the procedure in a project requires the inclusion of all stages in the risk management process when addressing hazards. The risk management process is segmented into many components, as enumerated below.

1.1 Risk identification:

Risk identification constitutes the initial phase of the risk management process, involving the recognition of all potential hazards that may emerge during the endeavor (Nnadi, et al. 2018). This preliminary phase establishes the foundation for later risk evaluation and management processes, allowing organizations to identify underlying risk domains. Precise risk identification ensures efficient risk management by uncovering hidden sources of losses that may escalate into accidents with uncontrollable repercussions (Ghasemi, et al., 2018). The repercussions of neglecting to recognize positive risks are analogous to failing to identify negative ones.

1.2 Risk assessment/analysis:

The subsequent phase in risk management, following identification, is the evaluation of the identified hazards. In risk management, risk assessment is the process of utilizing relevant information to evaluate the likelihood of occurrence and the severity of repercussions. Risk analysis may be conducted by qualitative or quantitative methods. Qualitative risk analysis involves assessing the likelihood and consequences of a risk, utilizing various methodologies, such as risk matrices. Quantitative risk analysis employs numerical data and mathematical models to measure and evaluate hazards. This facilitates data-driven decision-making and prioritization of risk management measures grounded in a more objective and quantitative comprehension of the associated hazards. Quantitative risk analysis employs methods such as the Analytical Hierarchy Process, Bayesian networks, and fuzzy set theory (Aven, 2016).

1.3 Risk response:

Risk response is a crucial element of the risk management process that ascertains if any actions will be taken in reaction to the risks evaluated during the identification, qualification, and quantification phases (Ghasemi, et al., 2018). Risk responses are established by presenting many options for eliminating or alleviating a projected risk and selecting the most effective alternative (Nnadi, et al. 2018). Risk response is the procedure of discovering or formulating alternative strategies to address risk and establishing actions for risk management, emphasizing opportunities and mitigating pressures to achieve the project's objectives. Therefore, it entails choosing an efficient method to alleviate the adverse effects of a risk (Zhang, 2016).

1.4 Risk Mitigation (Response Strategy):

Upon assessing risks, the subsequent stage is to formulate strategies for their mitigation or management. Four principal methodologies for risk management exist:

Avoidance: Modifying the project plan to eradicate the risk.

Mitigation: Implementing measures to diminish the probability or consequences of the risk.

Transfer: Allocating the risk to an external entity, typically via insurance or outsourcing.

Acceptance: Recognizing the danger and ready to address it if it materializes.

1.5 Risk Control:

Subsequent to identifying hazards, doing risk assessments, and formulating suitable solutions, the requisite steps must be executed. The implementation of the risk plan is a fundamental element of risk supervision and control, both of which should be integral components of the project. The primary challenge in the monitoring and controlling process is the implementation of risk solutions while assuring their efficacy. The creation of comprehensive documentation to facilitate the process represents the second major challenge to address. The project's risks are managed to provide successful overall project management. It is based on a proactive strategy rather than a reactive approach, trying to assure the adoption of suitable measures while continually adjusting them. The risk management process must exercise utmost caution at this stage to prevent actions based on misidentified or misanalyzed risks (Ugwu et al., 2019).

2. Common Risks Faced by Construction Projects and their Impact on Performance:

2.1 Financial Risks:

Financial risks in construction projects generally stem from budget overruns, inaccurate cost estimations, variations in material pricing, and finance complications. These risks may lead to expenses exceeding early projections, substantially affecting the project's financial feasibility. Prolonged funding acquisition or fluctuations in currency rates may result in elevated costs. The impact is mostly experienced through cost overruns, which can diminish profit margins and lead to financing deficits, eventually hindering the project's capacity to achieve its financial goals (Antón, et al.2011).

2.2 Delays and Schedule Risks:

Temporal hazards, including delays caused by unanticipated factors such as inclement weather, labor shortages, equipment malfunctions, or permitting complications, are prevalent in construction. These delays may prolong the project timetable, leading to missed deadlines and heightened expenses. Beyond immediate financial repercussions, extended construction timelines may result in contractual fines, discontented stakeholders, and forfeited commercial

prospects. Time overruns adversely impact project performance by prolonging delivery, decreasing stakeholder satisfaction, and eroding profitability (Tawfek, & Bera, 2018).

2.3 Health and Safety Risks:

Construction sites are rife with safety concerns, including accidents, injuries, and violations of safety rules. These hazards may result in job interruptions, heightened insurance costs, and potential legal obligations. In extreme instances, accidents may lead to fatalities or permanent injuries, thus tarnishing a project's image. Safety hazards adversely affect project performance by diminishing worker productivity, escalating expenses from lawsuits or fines, and causing delays during safety investigations.

2.4 Supply Chain and Material Shortages:

Disruptions in the supply chain, such as delays in material delivery or shortages of critical construction supplies, are prevalent risks in the construction industry. These risks may arise from logistical challenges, variations in market demand, or supplier bankruptcy. Material shortages frequently result in building delays, compelling project managers to seek alternate suppliers or materials, which may incur increased costs and potential quality compromises. Project performance deteriorates as delays extend the project's duration and unanticipated costs escalate, impacting profitability (Panova, & Hilletofth, 2018).

2.5 Labor Risks:

Construction projects rely on proficient labor, and risks associated with labor availability or strikes might result in considerable project delays. In the absence of trained personnel or the emergence of labor conflicts, projects may be delayed, leading to missed deadlines and heightened expenses from idle machinery or the necessity to engage costlier subcontractors. The aforementioned risks compromise job quality when less experienced personnel are employed to address deficiencies, resulting in possible rework and diminished overall quality.

3. The different approaches of risk management in construction projects:

Risk management in construction projects is essential for achieving effective outcomes, notably in controlling the budget, fulfilling stakeholder expectations, and maintaining the schedule. Diverse methodologies for risk management have been formulated and used to enhance these facets, each with distinct advantages and disadvantages. This document compares several risk management systems in building projects, focusing on their efficacy in managing budget, stakeholder requirements, and schedule compliance (Bahamid, et al.2022).

- ✓ **Qualitative Risk Management:** This methodology includes subjective assessment and the application of instruments such as risk matrices to prioritize hazards. Although it facilitates the early identification of significant risks, it is deficient in accurate financial projections and depends on subjective evaluations. It performs effectively in resource-constrained projects but may encounter difficulties with intricate budget and schedule predictions.
- ✓ **Quantitative Risk Management:** This methodology employs numerical data and statistical models to deliver comprehensive financial projections and accurate schedule modifications. Nonetheless, it is data-intensive and necessitates skill, which might be resource-intensive. It is optimally designed for extensive projects requiring precise budgeting and schedule analysis.
- ✓ **Integrated Risk Management:** This methodology amalgamates qualitative and quantitative techniques to deliver a comprehensive risk evaluation and ongoing surveillance. It is incredibly versatile, although its implementation can be intricate and expensive. It efficiently manages both money and timeline, but need strong systems (Arena, et al.2017).
- ✓ **Agile Risk Management:** This adaptable methodology prioritizes flexibility and ongoing input, rendering it useful for stakeholder involvement. Nonetheless, its emphasis on short cycles may hinder long-term planning, rendering it more appropriate for smaller projects (Moran, & Moran, 2014).

4. The main challenges or barriers to implementing effective risk management strategies in construction projects:

- ✓ **Lack of Awareness and Knowledge:** Numerous project stakeholders, such as contractors and managers, may lack a comprehensive understanding of the advantages of risk management or the efficient implementation of solutions. This knowledge deficiency results in inadequate risk identification and mitigation (Bahamid, et al.2022).

- ✓ **Cost Constraints:** Efficient risk management sometimes necessitates substantial monetary expenditure in instruments, procedures, and proficient staff. In building projects constrained by limited budgets, this expenditure may be perceived as superfluous or too expensive, resulting in insufficient risk management procedures.
- ✓ **Resistance to Change:** Construction projects frequently adhere to conventional methodologies, and the use of formal risk management may be perceived as disruptive. Opposition from management or employees to the adoption of new procedures or instruments can obstruct the execution of good risk strategies (Darmawan, & Azizah, 2020)
- ✓ **Lack of Integration in Project Planning:** Frequently, risk management is not comprehensively included into the project's overarching planning and decision-making frameworks. When risk factors are regarded independently from project management, it becomes increasingly difficult to evaluate and mitigate risks effectively throughout the project lifetime.
- ✓ **Complexity and Uncertainty:** Construction projects are intrinsically intricate, characterized by several uncertain factors including meteorological conditions, market dynamics, and labor availability. Effectively managing this complexity necessitates advanced risk management solutions, which are frequently challenging to formulate and implement consistently (Judson, & Paul, 2022).
- ✓ **Inadequate Communication:** Effective risk management necessitates collaboration among all project stakeholders, including clients, contractors, suppliers, and regulators. Inadequate communication or absence of explicit routes for disseminating risk-related information may result in misconceptions and lost chances for mitigation.

Previous Studies:

According to (Alshehhi, et al.2024). This paper explores the complex realm of risk management within the construction sector. This study also highlights its significant impact on the project's success. Diverse risk mitigation measures have been examined about their effects on essential project metrics, including schedule adherence, quality standards, and cost control, which collectively provide the foundation of this research. This research aims to assess the relationship between the project's outcomes and risk identification. This assesses the quantifiable effects of mitigation solutions and evaluates their efficacy in stakeholder satisfaction and budget management. This study seeks to elucidate the important connection between risk management and project success through empirical insights. It provides industry professionals with evidence-based strategies to enhance risk management methods, promoting resource allocation and resilience.The comparative examination of risk management strategies facilitates informed and suitable decision-making. This minimizes disturbance and improves financial results. These findings indicate a paradigm shift in construction project management, promoting a culture of effective and proactive risk management. It has the potential to transform industry practices, enhance predictability, and improve project performance. Implementing recommended tactics, fostering adaptation, ensuring clear communication, establishing a theoretical framework, and embracing complexity will successfully boost risk management, steering the construction sector toward continual development and innovation.

Regarding the research conducted by (Alsaadi & Norhayatizakuan, 2021). The literature extensively examines construction performance and risk management from multiple viewpoints. The primary aim of conducting risk management in the construction business is to guarantee the timely completion of quality construction within a specified budget. The increasing failure of several building projects to satisfy timelines, budgetary constraints, and quality standards is becoming more prevalent, resulting in substantial financial losses in Oman each year. Consequently, empirical evidence is required to elucidate the relationship between risk management and project performance. This research utilized quantitative approaches to investigate this link. Construction enterprises ranging from grade exceptional to grade second in Oman have been included in the survey. The results indicated that implementing risk management considerably enhances the performance of construction projects. It is imperative to employ qualified project managers possessing adequate expertise in risk management and its principal activities.

To the study of (Bukar, & Ibrahim, 2021). The building business is fraught with significant risks and several uncertainties, particularly due to the ongoing escalation of the COVID-19 epidemic. Evidence is plentiful regarding the severity of the impact, resulting in increased project abandonment, diminished financial inflow, and job losses. The objective of the research is to analyze the influence of risk management on the project performance within Nigeria's construction sector. A quantitative research design was employed, utilizing a descriptive study to gain deeper insights into the risks and risk management challenges within the business. Survey questionnaires were employed to gather data from 84 sample respondents. The collected data were analyzed using a basic linear regression model. The findings indicated that both internal and external risks, together with risk management, substantially influenced project

performance. The research paper summarizes the findings of a study done among the primary players (contractors, consultants, and the customer) of projects in Abuja, Lagos, and Port Harcourt, Nigeria. Furthermore, the findings indicated that the primary issue facing the construction industry regarding risk is the absence of a regulatory framework that companies and organizations may adopt and enforce. The Bureau of Public Procurement (BPP) is responsible for establishing and overseeing the framework, which will encompass risk audits, risk reassessment, technical performance evaluation, reserve analysis, and status meetings. The study enhances risk management in the construction industry to mitigate effects on project performance.

Regarding the research conducted by (Algremazy, et al. 2023). The primary objective of the study was to examine the application of risk management within the construction sector in Libya.This study delineates the significance of risk management within project management in the construction sector of Libya. The study encompassed almost three hundred construction firms situated in Tripoli and Benghazi, the two principal cities in Libya where building activity was most vigorous and entailed substantial projects and significant investment. Questionnaires constructed using cluster sampling were distributed to respondents, specifically firm managers, resulting in 250 replies. Structural equation modeling was employed to analyze the data using the Smart-PLS software. The risk management techniques, encompassing detection, assessment, and monitoring, which contributed to the project's success, were also associated with financial risk. The research indicated that risk management approaches significantly and positively influenced the project's execution success. The enhancement of understanding of quality management in relation to hazards was highly commendable. The present research findings indicate that the majority of studies emphasize the impact of risk management strategies as a robust mechanism for enhancing project performance. A productivity survey could provide a more comprehensive understanding of risk management in other areas concerning the real output of building firms.

Methodology:

1. Study Design:

The study utilizes a descriptive research approach to elucidate the impact of risk management strategies on the performance of construction projects. This architecture is suitable for elucidating the correlation between risk management tactics and project performance metrics, including cost, time, and quality. The study's descriptive style facilitates a thorough examination of existing methods, obstacles, and their effects on building results. The descriptive analytical technique refers to a scientific method for accurately characterizing the subject of study using a proper scientific methodology and presenting the findings as interpretable digital information (Lawless et al., 2010).

2. Research Method:

Research methods are systematic procedures or strategies employed by researchers to gather, analyze, and interpret data to address a research topic or evaluate a hypothesis. These methodologies establish a framework for executing research, guaranteeing that the study is systematically structured, dependable, and valid. Research technique includes the comprehensive approach and plan utilized in a research project (Khan et al., 2023).

The researcher employed a quantitative methodology as it aligned with the study's aims and objectives.

3. Study Population:

The term "population" refers to a collective of individuals from whom generalizations on the group's attributes and pertinent information may be inferred. Researchers find it intriguing to analyze populations as they embody a collective of individuals with distinct attributes. The capacity of scholars to engage with all members of the target community is directly influenced by financial, temporal, and focal limitations of the resource. The study population is crucial for identifying the persons or units who will be the subject of data collection and analysis.

These individuals are chosen for their direct engagement in risk management and oversight of construction project performance. The sample size will comprise 100 Construction Engineers engaged in risk management within the construction sector.

4. Data collection:

The phrase "data collection" denotes the systematic gathering and quantification of information on variables of interest to address research inquiries, evaluate hypotheses, and analyze outcomes. Data collection is a fundamental component of research across many disciplines, including the natural sciences, humanities, business, and others. The need of ensuring precise and reliable data collection is, however, universal. The objective of any data gathering initiative is to gather adequate information for comprehensive data analysis, which can subsequently be employed to formulate an argument that effectively resolves the issue at hand. The validity of research depends on precise data collection, applicable irrespective of the subject matter or the chosen data classification (quantitative or qualitative).

4.1 Secondary Sources:

Secondary data assists researchers in formulating research questions, enhancing comprehension of the study issue, and expanding knowledge of the subject matter. Furthermore, it aids in identifying pertinent research methodologies and provides a solid basis for the subsequent phases of the study. Secondary data not only contextualizes main data but also facilitates rapid comprehension and interpretation (Andrew, Pedersen, & McEvoy, 2019). Consequently, we do an exhaustive review of all pertinent study publications.

Secondary sources, including books and articles, have been utilized for data collecting.

4.2 Primary Sources:

Primary sources are essential components of data collecting that offer unique, personal knowledge or evidence directly pertinent to the study subject. These sources are crucial as they provide unprocessed data that has not been analyzed, condensed, or influenced by prior researchers or intermediaries.

To fulfill the research's aims, data were gathered by administering a questionnaire to the study population.

5. Data Analysis:

The word "data analysis" refers to the systematic and organized process of evaluating, cleansing, modifying, and interpreting data collected to derive conclusions, address research inquiries, or evaluate hypotheses. At this juncture, researchers employ several statistical and computational techniques to analyze the gathered data.

This study used SPSS for the statistical analysis of the questionnaire responses.

Results:

1. Demographic Questions:

1.1 Gender:

The subsequent table on the study sample's gender distribution indicates that males constitute 85%, while females account for 15%.

Table 1: Gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	85	85.0	85.0	85.0
	Female	15	15.0	15.0	100.0
	Total	100	100.0	100.0	

1.2 Age

It is evident from the following table regarding the distribution of the study sample according to age, that the highest percentage is (35 - 44 years) with 40%, followed by (25–34 years) with a percentage of 21%, (15–24 years) with a percentage of 20% (45 - 54 years) with a percentage of 11% and (More than 55 years) with a percentage of 8%.

Table 2:Age

Age				
		Frequency	Percent	Valid Percent
Valid	15–24 years	20	20	20
	25–34 years	21	21	21
	35 - 44 years	40	40	40
	45 - 54 years	11	11	11
	More than 55 years	8	8	8
	Total	100	100.0	100.0

1.3 Working status:

It is evident from the following table regarding the distribution of the study sample according to Working status, that the highest percentage is (Project Manager) with 38%, followed by (Site Supervisor) with a percentage of 22%, (structural engineer) with a percentage of 19% (Architect) with a percentage of 16% and (Safety Officer) with a percentage of 5%.

Working status					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Project Manager	38	38	38	38
	Site Supervisor	22	22	22	60
	Structural engineer	19	19	19	79
	Architect	16	16	16	95
	Safety Officer	5	5	5	100
	Total	100	100.0	100.0	

1.4 Working experience

It is evident from the following table regarding the distribution of the study sample according to Working status, that the highest percentage is (6-10 years) with 40%, followed by (More than 10 years) with a percentage of 35%, (Less than 1 year) with a percentage of 13% and (1-5 years) with a percentage of 12%.

Table 3: Working experience

Working experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 year	13	13	13	13
	1-5 years	12	12	12	25
	6-10 years	40	40	40	65
	More than 10 years	35	35	35	100
	Total	100	100.0	100.0	

2. The most common risks faced by construction projects:

- ✓ Statement "Financial risks in construction projects arise from budget overruns, inaccurate cost estimates, material pricing discrepancies, and financing complications." came in the first place with an arithmetic mean of 4.21 and a standard deviation of .902. Therefore, the direction of the responses of the study sample is Agree.
- ✓ Statement "Construction projects rely on skilled labor, and risks related to labor availability or strikes lead to significant project delays" came in the second order, with a mean of 4.13 and a standard deviation of .884. Therefore, the direction of the responses of the study sample is Agree.
- ✓ Statement "Supply chain disruptions, such as delays in material deliveries, are common risks in the construction industry" came in the third order, with an arithmetic mean of 4.13 and a standard deviation of .812. Therefore, the direction of the responses of the study sample is Agree.
- ✓ Statement "Safety concerns are prevalent on construction sites, leading to work interruptions and higher insurance costs" in the fourth rank came with an arithmetic mean of 4.09 and a standard deviation of .818. Therefore, the direction of the responses of the study sample is neutral.
- ✓ Statement "Delays caused by unforeseen factors such as bad weather and labor shortages lengthen project schedules and increase expenses" came in the fifth order, and its arithmetic mean was 4.00 and a standard deviation was .888. Therefore, the direction of the responses of the study sample is neutral.

The data clearly indicates that financial risks in construction projects, including budget overruns, faulty cost projections, material price differences, and financing issues, are some of the most substantial obstacles encountered. These financial risks lead to elevated project expenses and possible delays, underscoring the necessity for precise budgeting and cost control measures. Labor-related issues, such as availability and potential strikes, significantly contribute to project delays, hence affecting construction timetables. Moreover, supply chain interruptions, including delays in material deliveries, frequently occur, affecting the overall advancement of building projects. Although less visible, safety problems on construction sites nevertheless lead to work disruptions and heightened insurance expenses, necessitating rigorous compliance with safety measures. Ultimately, unpredictable elements like as inclement weather and workforce shortages prolong project timelines and increase costs, illustrating the intricacies of risk management in construction settings. Effective mitigation solutions are essential to manage these risks and guarantee timely project completion while preserving budgetary control.

Table 4 : Descriptive Statistics of the most common risks faced by construction projects

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Financial risks in construction projects arise from budget overruns, inaccurate cost estimates, material pricing discrepancies, and financing complications.	100	2	5	4.21	.902
Delays caused by unforeseen factors such as bad weather and labor shortages lengthen project schedules and increase expenses.	100	1	5	4.00	.888
Safety concerns are prevalent on construction sites, leading to work interruptions and higher insurance costs.	100	3	5	4.09	.818
Supply chain disruptions, such as delays in material deliveries, are common risks in the construction industry.	100	3	5	4.13	.812
Construction projects rely on skilled labor, and risks related to labor availability or strikes lead to significant project delays.	100	2	5	4.13	.884
The most common risks faced by construction projects	100	3.00	5.00	4.1120	.48017
Valid N (listwise)	**100**				

Table 5 : Frequency &Percent of the most common risks faced by construction projects

S	Strongly disagree		not agree		Neutral		Agree		Strongly Agree	
	F	%	F	%	F	%	F	%	F	%
Financial risks in construction projects arise from budget overruns, inaccurate cost estimates, material pricing discrepancies, and financing complications.	-	-	3	3%	23	23%	24	24%	50	50%
Delays caused by unforeseen factors such as bad weather and labor shortages lengthen project schedules and increase expenses.	2	2%	2	2%	21	21%	44	44%	31	31%
Safety concerns are prevalent on construction sites, leading to work interruptions and higher insurance costs.	-	-	-	-	29	29%	33	33%	38	38%
Supply chain disruptions, such as delays in material deliveries, are common risks in the construction industry.	-	-	-	-	27	27%	33	33%	40	40%
Construction projects rely on skilled labor, and risks related to labor availability or strikes lead to significant project delays.	-	-	3	3%	24	24%	30	30%	43	43%

3. The different approaches of risk management in construction projects:

✓ Statement “Agile risk management focuses on short cycles, making it more suitable for smaller projects” came in the first place with an arithmetic mean of 4.22 and a standard deviation of .675. Therefore, the direction of the responses of the study sample is Agree.

- ✓ Statement "Integrated risk management combines qualitative and quantitative techniques to provide comprehensive risk assessment and ongoing monitoring" came in the second order, with a mean of 4.21 and a standard deviation of .832. Therefore, the direction of the responses of the study sample is Agree.
- ✓ Statement "Quantitative risk management uses numerical data and statistical models to provide comprehensive financial forecasts and accurate schedule adjustments " mean of 4.15 and a standard deviation of .687. Therefore, the direction of the responses of the study sample is Agree.
- ✓ Statement "Agile risk management prioritizes flexibility and continuous input, making it useful for engaging stakeholders on projects" in the fourth rank came with an arithmetic mean of 3.89 and a standard deviation of .751. Therefore, the direction of the responses of the study sample is neutral.
- ✓ Statement "Qualitative risk management facilitates early identification of significant risks, but lacks accurate financial forecasts and relies on subjective assessments" came in the fifth order, and its arithmetic mean was 3.87 and a standard deviation was .812. Therefore, the direction of the responses of the study sample is neutral.

The statistics clearly indicated that various risk management strategies in building projects differ in their efficacy. Agile risk management, emphasizing brief cycles, was deemed especially appropriate for smaller projects, with substantial consensus among the research participants. Integrated risk management, which merges qualitative and quantitative methodologies, garnered substantial endorsement for its capacity to deliver thorough risk evaluation and continuous oversight. Quantitative risk management, recognized for employing numerical data and statistical models for financial projections and schedule modifications, was also regarded positively. The focus of agile risk management on adaptability and stakeholder involvement received a tempered reaction, indicating a mix between consensus and ambivalence. The study sample held a neutral perspective on qualitative risk management, which enables early risk detection but lacks accurate financial forecasting.

Table 6 : Descriptive Statistics of the different approaches of risk management in construction projects

Descriptive Statistics						
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**	**p-value**
Qualitative risk management facilitates early identification of significant risks, but lacks accurate financial forecasts and relies on subjective assessments.	**100**	**3**	**5**	**3.87**	**.812**	**0.001**
Quantitative risk management uses numerical data and statistical models to provide comprehensive financial forecasts and accurate schedule adjustments.	**100**	**3**	**5**	**4.15**	**.687**	**0.001**
Integrated risk management combines qualitative and quantitative techniques to provide comprehensive risk assessment and ongoing monitoring.	**100**	**2**	**5**	**4.21**	**.832**	**0.320**
Agile risk management prioritizes flexibility and continuous input, making it useful for engaging stakeholders on projects.	**100**	**3**	**5**	**3.89**	**.751**	**0.121**
Agile risk management focuses on short cycles, making it more suitable for smaller projects.	**100**	**3**	**5**	**4.22**	**.675**	**0.603**
The different approaches of risk management in construction projects	**100**	**3.00**	**4.60**	**4.0680**	**.36979**	

Valid N (listwise)	**100**					

Table 7: Frequency &Percent of the different approaches of risk management in construction projects

S	Strongly disagree		not agree		Neutral		Agree		Strongly Agree	
	F	%	F	%	F	%	F	%	F	%
Qualitative risk management facilitates early identification of significant risks, but lacks accurate financial forecasts and relies on subjective assessments.	-	-	-	-	40	40%	33	33%	27	27%
Quantitative risk management uses numerical data and statistical models to provide comprehensive financial forecasts and accurate schedule adjustments.	-	-	-	-	17	17%	51	51%	32	32%
Integrated risk management combines qualitative and quantitative techniques to provide comprehensive risk assessment and ongoing monitoring.	-	-	2	2%	20	20%	33	33%	45	45%
Agile risk management prioritizes flexibility and continuous input, making it useful for engaging stakeholders on projects.	-	-	-	-	34	34%	43	43%	23	23%
Agile risk management focuses on short cycles, making it more suitable for	-	-	-	-	14	14%	50	50%	36	36%

smaller projects.										

Conclusion:

This research highlights the critical significance of proficient risk management within the construction sector. By methodically identifying and mitigating diverse risks, building projects may markedly enhance their performance regarding cost management, timetable compliance, and overall quality. The report underscores the imperative for construction companies to implement customized risk management methods that correspond with project-specific difficulties and stakeholder requirements. The amalgamation of qualitative and quantitative risk assessment methodologies fortifies risk management strategies, allowing firms to promptly address new risks and uncertainties. Ultimately, the implementation of good risk management not only ensures successful project delivery but also cultivates trust and satisfaction among stakeholders, underscoring the importance of risk management as a crucial element of successful construction project management.

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