EFFECT OF MATERIALS PROCUREMENT RISKS FACTORS ON PERFORMANCE OF BUILDING PROJECTS IN ABUJA, NIGERIA

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ABSTRACT

The problem of building materials procurement risks remains a serious problem requiring urgent attention in the Nigerian building construction industry. This problem could be linked to slowness of the industry in adapting modern techniques on risks management in building construction projects. Thus, this research aims to appraise the effect of material procurement risks factors on the performance of building projects in with a view to improving project performance in Nigeria.The study adopted a survey design approach using quantitative method. Data were collected using well-structured questionnaire administered to 153 respondents including, procurement officers, project managers, site managers and contractors of 61-active building construction sites that are located and operating within Abuja, using stratified random sampling method. A total of 139 questionnaires were retrieved from 153 administered. The collected data were analysed using descriptive methods, including frequencies, percentages, Mean Item Score (MIS) and Relative Importance Index (RII). The study revealed that inflation, third party delay and default, uncertain research and development results were the inherent building materials procurement risks, with average RII value of 0.75. Also, the prominent building materials procurement risks that have impact on the cost, time, quality performance on building projects were: design too rigid for change, unexpected changes in demand, bad debt, inflation, quality control and assurance, security, differing site condition, responsiveness of suppliers, quality control and assurance. Also, the most important building materials procurement risk mitigation strategies are: reducing the scope of the contract, adding resources or time to the contract, avoiding contractor with unproven track record, using a proven approach instead of a new one, contingency plans, error tolerant design-user interface, due diligence and policies design to reduce risk. Based on the findings, the study recommended proper implementation of the ways of dealing and managing risks, as it would help particularly the building sectors for managing building materials procurement risks.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The construction industry contributes to the socio-economic growth of any nation by improving the quality of life, generating employments and providing the infrastructure, such as roads, hospitals, schools, and other basic facilities. Hence, it is imperative that construction projects are completed within the scheduled period of time, within the budgeted cost, and meet the anticipated quality (Saidu & Shakantu, 2016).

Material procurement involves the analysis of various vendors, making adequate decision to ensure that materials are bought at the right quality, in the right quantity, at the right time, at the right price, and from the right source (Ibegbulem & Okorie, 2015). In the construction industry, materials procurement follows a procedure to ensure that adequate materials are made available on site at the right time and of the right quality which includes: material indent, searching for vendors, interviewing/comparing vendors, selecting vendors, placing order and evaluating the performance of the vendors (Patience *et al.,* 2017). Tunji-Olayeni *et al.* (2017) noted that certain components are necessary for successful material procurement including: price, quality, quantity, capability of vendor, vendor reputation, waiting time and sales offer. These factors have both direct and indirect impacts on project outcomes.

Khyomesh and Vyas (2011) stated that the costs of materials procurement are significantly influenced by various factors such as: improper materials handling and management on site during construction production processes. As a result, materials procurement strategies have been observed to influence the quality, time and socio-economic sustainability of the project. However, challenges arising from poor materials procurement on construction sites still persists including errors in ordering materials,

difficulties in ordering materials in small materials; delays in material delivery, problems associated with material transportations, handling and storage, production of defective materials and general poor resource control on site (Glass *et al.,* 2014; Aibinu & Odeyinka, 2016; Bossink & Brouwers, 2015; Poon *et al.,* 2014; Formoso *et al.,* 2012). Material in particular covers about 60% of total construction cost (Kasim *et al.,* 2016; Gulghane & Khandve, 2015; Patil & Pataskar, 2013). Moreover, the rising price of building materials and the escalating cost of construction have become topical in many countries (Amusan *et al.,* 2017; Tunji-Olayeni & Omuh, 2013). Hence, efficient material procurement holds great potentials for significant cost savings for construction projects (Amusan, *et al.,* 2017). Kolenko (2016) states that risk in procurement is measured from a transactional point of view where risk management is dedicated to things that can go wrong in the procurement process. Risk identification is widely accepted to be the first and the key step of material procurement risk management process, because of the fact that all the succeeding steps and actions will be based on it.

Consequently, understanding the main categories of risk faced in the materials procurement process will assist in risk assessment and planning, and devising the management and operational measures that will be taken to mitigate those risks (United Nations Procurement Practitioners Handbook, 2012). For this reason, effective materials procurement risk management practice requires an understanding of the relationship between procurement and organisational objectives (Okonjo, 2014).

The aforementioned challenges have become enormous problems faced by Nigerian construction companies in the management of materials procurement which is the bane of successful project delivery. It is against these backdrops that this study seeks to come up with strategies for managing building materials procurement risks in Abuja, with a

view to minimising the endemic problems of materials procurement risks in building construction projects in Nigeria.

1.2 Statement of the Research Problem

Despite the considerable amount of literatures on building materials procurement risks management across the world, and several efforts by construction practitioners to manage the challenges involved in materials procurement in building projects, risks still remains a serious problem requiring urgent attention in the Nigerian building construction industry (Tunji-Olayeni *et al.,* 2017). This problem could be linked to lack of detailed and documented previous data on materials procurement risks management processes on how to manage those risks in building construction projects (Ibironke, 2013; Okonjo, 2014; Amusan *et al.,* 2017).

Olaniyan *et al.* (2015) also attributed the problem to little understanding of materials procurement risk management strategies by procurement officer, project managers and contractors which is affecting the performance of building projects. Despite the huge impact materials procurement disruptions have on building projects bottom line profits, many construction firms still do not have ways to manage material procurement risks where they can identify the potential risk within their material procurements and come up with contingency plans and mitigations for the material procurement risks that may affect the organisation performance; there are now more risks to the material procurement and risk events are becoming more costly (Emily, 2013; Caroline, 2015).

Therefore, the problem in this study is that: the processes for managing building materials procurement risks in Nigeria require a modern strategy to improve ways of minimising building materials procurement risk factors on the performance of building project during construction process to avoid cost, time overrun and also poor quality of work leading to project abandonment. Existing literatures on risk factors in procurement were deficient in

the following area: not suitable for large and complex construction works; have proven to be more complicated and difficult to understand; insufficient empirical data; and did not focused specifically on building projects. Thus, this research intends to develop strategies to manage materials procurement risks factors on the performance of building projects.

1.3 Research Questions

To clearly give direction to this study and achieve its objectives, the following research questions were formulated:

1. What are the materials procurement risk factors in building projects?
2. What are the effects of the materials procurement risks factors on time, cost and quality performance of building projects?
3. What strategies could be adopted to deal with materials procurement risks in building construction projects for improved project performance?

1.4 Aim and Objectives of the Study

The aim of the study is to appraise the effect of material procurement risks factors on the performance of building projects in with a view to improving project performance.

To achieve the aim, the following objectives are formulated to:

1. Examine the inherent materials procurement risk factors in building projects;
2. Examine the effect of the materials procurement risks factors on time, cost and quality performance of building projects;
3. Determine strategies for dealing with materials procurement risks in building construction projects for improved project performance.

1.5 Justification for the Study

To justify the gap for this research, the contributions of the following researchers cannot be over emphasised. Subramani1 and Prabhu (2018) studied material procurement in construction industry problems and solutions identified material demand problem sometimes occurs due to external events, such as delays in permit, inspection, material quality, availability of material, labor, weather, etc., that can affect the project completion date. Ho *et al.* (2015) in their research on supply chain risk management identified five categories of material procurement risks: macro, demand, manufacturing, supply and infrastructural (information, transportation, and financial) factors. Chacon *et al.* (2011) also in their research on new models for addressing supply chain and transport risk identified external risks associated with materials procurement which include floods, terrorism, strikes and natural disasters.

Existing literatures on material procurement risks concentrated on the manufacturing industry, but very few that relate to construction activities are those of Eriksson and Westerberg (2011) developed a conceptual framework on effect material procurement on construction project performance, the framework proposes three possible relationships among procurement procedures and project performance which make it quite complicated to implement, or even be well understood, in the built environment and this is due to the fact that data collected were not large enough and empirical evidence delineating this in a more holistic way is lacking. Dim and Ezeabasili (2015) developed and implemented a strategic materials procurement plan as an effective approach to development of public construction projects in Nigeria. Also, Richard *et al.*, (2017) conducted an assessment of the risks in the material procurement development cycle based on Risk Priority Number (RPN). In their paper, risk categorization and analysis were presented to assist in the management of the risks in the internal construction environment. The study makes a

significant contribution to knowledge, risk identification and assessment, but it has a complicated process that makes it hard to understand.

From the foregoing, it can be deduced that previous studies on effect of materials procurement risks factors on performance of building projects are mostly foreign based and these studies did not provide clear indication or worked specifically on how to reduce the effect building materials procurement risks specifically in Abuja, Nigeria. There is also no known literature on how to manage effect of materials procurement risks factors on performance of building projects which is being used and practiced by firms in Abuja, Nigeria and these serve as the gap this research intends to fill.

The research is significant to procurement officers, project managers, site managers and contractors, particularly building construction firms on the application of building materials procurement risks management practices. This will pave way in achieving the goal of construction firms of producing an effective and efficient construction projects within the stipulated time, cost and quality.

1.6 Scope of the Study

The research covers effect of materials procurement risks factors on performance of building projects in Abuja, Nigeria. Abuja as a geographical scope is selected because it is one of the metropolitan cities in Nigeria that has the high population of building construction projects and many professionals. The contextual scope of this study encompasses procurement officers, project managers, site managers and contractors on building construction projects.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Concept of Materials Procurement

Materials procurement is one of the activities involved in logistics (Patience *et al.*, 2017. Materials Procurement (MP) is the primary objective of materials management in a project management system (Patel & Vyas, 2011). MP is the process of purchasing materials from external sources to support the operations of the producing company (Kasim, 2011). Furthermore, Hadikusumo *et al.* (2015) and Mehr (2013) described MP as a fundamental function of acquiring goods and services based on established terms and conditions mutually acceptable by buyers and sellers to enhance work efficiency.

The objectives of material procurement are stated as buying the best item at right quality, quantity, time and cost (Akinson, 2015). According to Bima *et al.* (2015) effective material management system can bring many benefits for a company such as reducing the overall costs of materials, better handling of materials, reduction in duplicated orders, materials will be on site when needed and in the quantities required, improvements in labour productivity, improvements in project schedule, quality control, better field material control, better relations with suppliers, reduce of materials surplus, reduce storage of materials on site, labour savings, stock reduction, purchase savings and better cash flow management.

2.2 Materials Procurement Management in Construction

Construction materials procurement is termed sustainable if the processes of acquiring materials have minimal impact on the socioenvironmental status of a region through the lifecycle of the building (Meehan & Bryde 2011, Musa *et al.*, 2013). Hence, based on the definitions and explanations above, materials procurement (MP) could be categorised as

a management objective which involves the process of purchasing materials in its right quality, at the right time, in the right quantity, from the right sources (external or internal) and at an affordable price.

In most construction organisations, the activities of materials procurement (MP) are the responsibilities of the procurement department (Aibinu & Odeyinka, 2016). Practically, procurement officers or buyers performs vital functions to ensure that the materials requirement for a project are provided for timely (Haddad, 2016). As a result, Hadikusumo *et al.* (2015) itemized the following as functions of the procurement officer towards effective materials procurement during construction:

i. Identification of materials requirement for the construction project
ii. Processing and issuance of internal requisition (Request for Quotation 'RFQ')
iii. Bidding processes with sales representatives
iv. Identification of pre-qualification of bidders, bid evaluations and enlisting approved bidders
v. Carrying out market surveys for specific materials
vi. Solicitation of bids and price quotations
vii. Bid classification and awarding suppliers.
viii. Issuing of purchase orders (PO), subcontracts or leases.
ix. Materials tracking and expediting
x. Inspection and acceptance of delivered goods.
xi. Inventory maintenance: preservation of all company purchases records.

From Figure 2.1, it shows the process of procurement and functions of procurement officers in large construction companies. As seen in Figure 2.1, the client relates directly with the project team on contract appraisals and approvals in terms of tender's analysis and purchase orders. The contractor works directly with the project manager and

procurement officers in obtaining quotations from sub-contractors and suppliers to prepare a tender document which is to be presented to the client for analysis and approval. Therefore, in order to optimise construction performance and maximise profitability, procurement officers are advised to adopt the principles of procurement during construction as identified by Baily *et al.* (2013) below:

i. To ensure the flow materials and services during construction (Supply chain concept)
ii. To purchase materials wisely and efficiently based on ethical means at the best value for revenue spent (Best practice management)
iii. To maintain an effective relationship with the existing sources and develop new supply sources to meet emerging needs and to ensure continuity of supply (Relationship management)
iv. To maintain the correct quality/value balance (Total quality management).
v. To adopt environmentally responsible supply management system

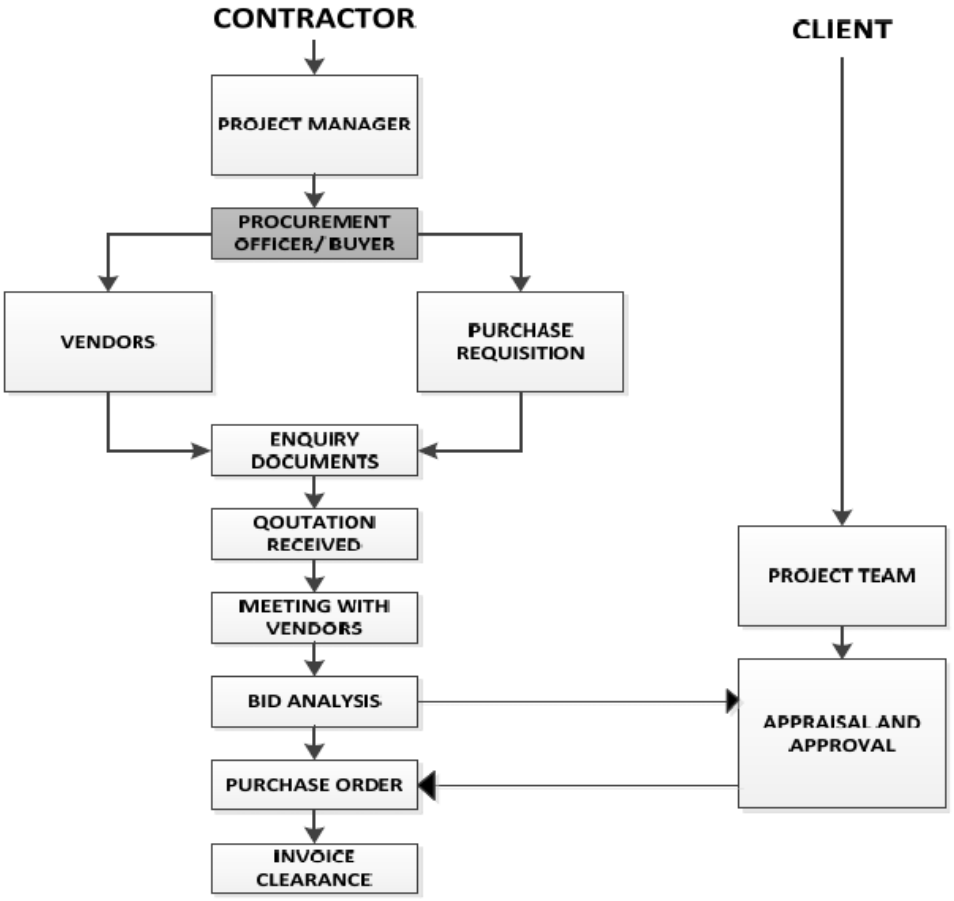

Figure 2.1: Typical function of procurement officers in a materials procurement system
Source: Baily *et al.*, 2013

2.3 Material Procurement Risks in Building Construction

Procurement risk is defined as the possibility of failures in a procurement process (Harland *et al.,* 2013). Procurement risk includes; cost, quality, fraud, and delivery (Hatush & Skitmore, 2012). Kolenko (2016) states that risk in procurement is measured from a transactional point of view where risk management is dedicated to things that can go wrong in the procurement process. This transactional point of view is concerned with actions that may contribute towards failure to comply with the required procurement process, inadequacy of the procurement process to achieve the commercial outcome, and a break down in the procurement process (Sim & Pabala, 2012). Companies often

overlook procurement decisions, and this may lead to major difficulties in completing the project (Martindale, 2015).

A construction company faces many challenges, which include discontinuity and disruption in the procurement of essential materials, unavoidable increases in project costs and in unit costs of purchased materials, both immediate and long-term loss of power and impact on relationships with essential suppliers, inability to meet customer demand, procurement functions that do not support organisational objectives, factors that weaken a company's ability to respond with speed and agility to meet changing circumstances, opportunity for fraud and corruption during the tendering process, and negative impact on reputation in the market place (Ritchie & Brindley, 2012). Fundamental challenges during procurement in the construction industry comprises of external factors such as labour, safety or other laws, nuclear pollution, supersonic bangs damage due to war, government policy on taxes, industrial disputes, and malicious damage to property (Teresa *et al.,* 2015). These challenges often give rise to procurement risk in the company (Muelbrook, 2012). Speculative risk is something which can be allocated in advance as decided by the parties in the contract (Seifbarghy, 2014). This may involve loss of time and money, as a consequence of exceptionally adverse weather, unforeseeable shortages of labour or materials, unexpected ground conditions, and other similar difficulties beyond the control of the contractor (Zsidisin & Smith 2015). Ho *et al.,* 2015 have identified five categories of material procurement risks: macro, demand, manufacturing, supply and infrastructural (information, transportation, and financial) factors. Other external risks include floods, terrorism, strikes, natural disasters (Chacon *et al.,* 2011).

Rao and Goldsby (2015) expressed the need for a typology that explicitly identifies the potential sources of risk in the material procurement. They provided a comprehensive

literature review on material procurement risk management and developed a typology of risk sources for the material procurement, comprising of industry factors (for instance new and existing competitors, fluctuations in users' demand and shifts in market supply), environmental factors (like war, changes in government policy or regulations, price fluctuations, and changes in interest rates), decision-maker related factors (like knowledge of decision makers), organizational factors (for instance raw materials shortages, machine failure, and labour uncertainties) and problem-specific factors (like complexity of decision tasks) (Saha, 2015). Given the comprehensiveness of Rao and Goldsby's (2015) literature review, it would be inappropriate to repeat similar details here and hence, their work can be adopted and tested in a new context (construction). Such analysis will provide valuable insights for researchers and practitioners who are interested in construction material procurement management. Hence, risk factors that may suit construction Material procurement in the Nigerian setting were identified. Table 2.1 shows the potential risks factors that are likely to occur in construction material procurement of building in Nigeria identified from literature.

Table 2.1; Potential Risks in Construction Material Procurement

S/NO	RISK FACTORS	SOURCES
1.	Policy changes	Rao and Goldsby (2015)
2.	Fluctuations in prices	Rao and Goldsby (2015)
3.	Natural occurrences for instance fire	Chacon *et al.* (2011)
4.	Shortage of raw materials	Rao and Goldsby (2015)
5.	Unexpected changes in demand	Rao and Goldsby (2015)
6.	New and existing competitors	Rao and Goldsby (2015)
7.	Bad debt	Saha (2015)
8.	Changes in interest rates	Saha (2015)
9.	Uncertain research and development results	Saha (2015)
10.	Labour uncertainties (for instance strikes)	Chacon *et al.* (2011)
11.	Frequent changes in supply chain inputs	Saha (2015)
12.	Fragmented decision-making	Saha (2015)
13.	Quality/excessive snagging	Ho *et al.* (2015)
14.	Inappropriate design for scheme	Ho *et al.* (2015)
15.	Site impact on local community	Ho *et al.* (2015)
16.	Incompetency of site management	Ho *et al.* (2015)
17.	Volatility of supply chain workflow	Ho *et al.* (2015)
18.	Ineffectiveness of arrangements	Teresa *et al.* (2015)
19.	New technology or technique	Teresa *et al.* (2015)
20.	Inconsistency of suppliers	Teresa *et al.* (2015)
21.	Inflexible design	Teresa *et al.* (2015)
22.	Experience of subcontractors	Teresa *et al.* (2015)
23.	Incompetency of project team	Saha (2015)
24.	Security	Saha (2015)
25.	Responsiveness of suppliers	Ho *et al.* (2015)
26.	Changes in quantity/scope of work	Ho *et al.* (2015)
27.	Inflation	Ho *et al.* (2015)
28.	Quality control and assurance	Kolenko (2016)
29.	Difficulties/delays in availability of materials, equipment and labour	Kolenko (2016)
30.	Bureaucratic problems	Chacon *et al.* (2011)
31.	Inadequate specifications	Kolenko (2016)
32.	Permit and approval	Kolenko (2016)
33.	Owner and contractor experience	Kolenko (2016)
34.	Site access/right of ways	Ritchie *et al.* (2012)
35.	Design changes	Ritchie *et al.* (2012)
36.	Third party delay and default	Ritchie *et al.* (2012)
37.	Financial failure-any party	Ritchie *et al.* (2012)
38.	Differing site conditions (unforeseen site conditions)	Chacon *et al.* (2011)
39.	Delay in design/redesign if over budget	Ritchie *et al.* (2012)
40.	Exceptionally inclement weather	Chacon *et al.* (2011)

2.4 Material Procurement Risks Factors and Performance of Building Projects

In material procurement management, due to increasing complexity and interrelations of materials procurement, the type and nature of uncertain developments or the impact of any action have become hard or even impossible to predict (Helbing *et al.*, 2016). Material procurement managers are unprepared to deal with uncertain events in general (Alcantara & Riglietti, 2015). The increased frequency and the severe consequences of past materials procurement disruptions have resulted in an increasing interest in risk. This development has led to the adoption of the risk concepts, terminologies and methods from related fields (Heckmann *et al.,* 2015).

2.4.1 Material procurement risks factors that affects time performance of building projects

Table 2.2 shows material procurement risk factors related to time on the performance of building projects in Nigeria identified from literature. These factors are independent factors and have been considered in the study separately. Then, the list was reduced to the 28 risk factors that most influence building materials procurement. These key factors are mostly quantitative and can be evaluated at different stages during construction (Helbing *et al.,* 2016).

In addition, automating frequent updates of these factors is perceived to greatly improve building materials procurement management and their impacts on project time (Saha, 2015).

Table 2.2; Time related risk factors

S/NO	RISK FACTORS	SOURCES
1.	Permit and approval	Kolenko (2016)
2.	Changes in quantity/scope of work	Ho *et al.* (2015)
3.	Owner and contractor experience	Kolenko (2016)
4.	Site access/right of ways	Ritchie *et al.* (2012)
5.	Design changes	Ritchie *et al.* (2012)
6.	Difficulties/delays in availability of materials, equipment and labour	Kolenko (2016)
7.	Third party delay and default	Ritchie *et al.* (2012)
8.	Financial failure-any party	Ritchie *et al.* (2012)
9.	Differing site conditions (unforeseen site conditions)	Chacon *et al.* (2011)
10.	Bureaucratic problems	Chacon *et al.* (2011)
11.	Inadequate specification	Kolenko (2016)
12.	Delay in design/redesign if over budget	Ritchie *et al.* (2012)
13.	Exceptionally inclement weather	Chacon *et al.* (2011)
14.	Force majeure	Chacon *et al.* (2011)
15.	Shortage of raw materials	Rao and Goldsby (2015)
16.	Unexpected changes in demand	Rao and Goldsby (2015)
17.	New and existing competitors	Rao and Goldsby (2015)
18.	Bad debt	Saha (2015)
19.	Inappropriate design for scheme	Ho *et al.* (2015)
20.	Inflexible design	Teresa *et al.* (2015)
21.	Responsiveness of suppliers	Ho *et al.* (2015)
22.	Incompetency of project team	Ho *et al.* (2015)
23.	Experience of subcontractors	Teresa *et al.* (2015)
24.	Inconsistency of suppliers	Teresa *et al.* (2015)
25.	Incompetency of site management	Ho *et al.* (2015)
26.	Policy changes	Rao and Goldsby (2015)
27.	Volatility of supply chain workflow	Ho *et al.* (2015)
28.	Ineffectiveness of arrangements	Teresa *et al.* (2015)

2.4.2 Material procurement risks factors that affect cost performance of building projects

Table 2.3 shows material procurement risk factors related to cost on the performance of building projects in Nigeria identified from literature. These factors are independent factors and have been considered in the study separately. Then, the list was reduced to the 25 risk factors that most influence building materials procurement. These key factors

are mostly quantitative and can be evaluated at different stages during construction (Helbing *et al.,* 2016).

In addition, automating frequent updates of these factors is perceived to greatly improve building materials procurement management and their impacts on project cost (Saha, 2015).

Table 2.3; Cost related risk factors

S/NO	RISKS FACTORS	SOURCE
1.	Changes in quantity/scope of work	Ho *et al.* (2015)
2.	Inflation	Ho *et al.* (2015)
3.	Quality control and assurance	Kolenko (2016)
4.	Difficulties/delays in availability of materials, equipment and labour	Kolenko (2016)
5.	Bureaucratic problems	Chacon *et al.* (2011)
6.	Inadequate specifications	Kolenko (2016)
7.	Force majeure	Chacon *et al.* (2011)
8.	Owner and contractor experience	Kolenko (2016)
9.	Fluctuations in prices	Rao and Goldsby (2015)
10.	Policy changes	Rao and Goldsby (2015)
11.	Unexpected changes in demand	Rao and Goldsby (2015)
12.	Labour uncertainties (for instance strikes)	Chacon *et al.* (2011)
13.	Frequent changes in supply chain inputs	Saha (2015)
14.	Bad debt	Saha (2015)
15.	New technology or technique	Teresa *et al.* (2015)
16.	Security	Saha (2015)
17.	Changes in quantity/scope of work	Ho *et al.* (2015)
18.	Changes in interest rates	Saha (2015)
19.	Uncertain research and development results	Saha (2015)
20.	Differing site conditions (unforeseen site conditions)	Chacon *et al.* (2011)
21.	Financial failure-any party	Ritchie *et al.* (2012)
22.	Site impact on local community	Ho *et al.* (2015)
23.	Shortage of raw materials	Rao and Goldsby (2015)
24.	Design changes	Ritchie *et al.* (2012)
25.	New and existing competitors	Rao and Goldsby (2015)

2.4.3 Material procurement risks factors that affect quality performance of building projects

Table 2.4 shows material procurement risk factors related to quality on the performance of building projects in Nigeria identified from literature. These factors are independent factors and have been considered in the study separately. Then, the list was reduced to the 19 risk factors that most influence building materials procurement. These key factors are mostly quantitative and can be evaluated at different stages during construction (Helbing *et al.,* 2016).

In addition, automating frequent updates of these factors is perceived to greatly improve building materials procurement management and their impacts on project cost (Saha, 2015).

Table 2.4; Quality related risk factors

S/NO	RISK FACTORS	SOURCES
1.	Quality control and assurance	Kolenko (2016)
2.	Owner and contract experience	Kolenko (2016)
3.	Inadequate specifications	Kolenko (2016)
4.	Differing site condition (unforeseen ground conditions)	Chacon *et al.* (2011)
5.	Force majeure	Chacon *et al.* (2011)
6.	Shortage of raw materials	Rao and Goldsby (2015)
7.	Unexpected changes in demand	Rao and Goldsby (2015)
8.	Bad debt	Saha (2015)
9.	Changes in interest rates	Saha (2015)
10.	Labour uncertainties (for instance strikes)	Chacon *et al.* (2011)
11.	Frequent changes in supply chain inputs	Saha (2015)
12.	Quality/excessive snagging	Ho *et al.* (2015)
13.	Incompetency of site management	Ho *et al.* (2015)
14.	Inconsistency of suppliers	Teresa *et al.* (2015)
15.	Inflexible design	Teresa *et al.* (2015)
16.	Experience of subcontractors	Teresa *et al.* (2015)
17.	Incompetency of project team	Saha (2015)
18.	Responsiveness of suppliers	Ho *et al.* (2015)
19.	Changes in quantity/scope of work	Ho *et al.* (2015)

In this step, the key building materials procurement risks factors were grouped accordingly showing the relationship of the identified material procurement risks on performance (time, cost and quality) of building projects in Nigeria identified from literature.

Table 2.5; Material procurement risks factors affecting time, cost and quality performance of building projects

S/NO	FACTORS	TIME	COST	QUALITY
1.	Policy changes	√	√	
2.	Fluctuations in prices		√	
3.	Force majeure	√	√	√
4.	Shortage of raw materials	√	√	√
5.	Unexpected changes in demand	√	√	√
6.	New and existing competitors	√	√	
7.	Bad debt	√	√	√
8.	Changes in interest rates		√	√
9.	Uncertain research and development results		√	
10.	Labour uncertainties (for instance strikes)		√	√
11.	Frequent changes in supply chain inputs		√	√
12.	Fragmented decision-making	√		
13.	Quality/excessive snagging			√
14.	Inappropriate design for scheme	√		
15.	Site impact on local community		√	
16.	Incompetency of site management	√		√
17.	Volatility of supply chain workflow	√		
18.	Ineffectiveness of arrangements	√		
19.	New technology or technique		√	
20.	Inconsistency of suppliers			√
21.	Inflexible design	√		√
22.	Experience of subcontractors			√
23.	Incompetency of project team	√		√
24.	Security		√	
25.	Responsiveness of suppliers	√		√
26.	Changes in quantity/scope of work	√	√	√
27.	Inflation		√	
28.	Quality control and assurance		√	√
29.	Difficulties/delays in availability of materials, equipment and labour	√	√	
30.	Bureaucratic problems	√	√	
31.	Inadequate specifications	√	√	√
32.	Permit and approval	√		
33.	Owner and contractor experience	√	√	√
34.	Site access/right of ways	√		
35.	Design changes		√	
36.	Third party delay and default	√		
37.	Financial failure-any party	√	√	
38.	Differing site conditions (unforeseen site conditions)	√	√	
39.	Delay in design/redesign if over budget	√		
40.	Exceptionally inclement weather	√		
	Total in percentage of occurrence	**70%**	**63%**	**48%**

2.5 Risks Management in Materials Procurement

Managing risk in construction materials procurement remains a current topic of research interests and both researchers and practitioners have conducted several key studies on Materials Procurement Risk Management (Jüttner *et al*., 2013; Khan & Burnes, 2016; Wagner & Bode, 2017; Seshadri & Subrahmanyam, 2015). For example, Tang (2016) proposed that Materials Procurement Risk Management is: "the management of material procurement risks through coordination or collaboration among the materials procurement partners so as to ensure profitability and continuity." Whereas Christopher and Lee 2014) states that Materials Procurement Risk Management utilizes a coordinated approach among members of the materials procurement to manage external risks so as to minimize the vulnerability of the whole Material procurement.

Rao and Goldsby (2015) conducted a thematic review of research into Materials Procurement Risk Management and concluded that limited work had been implemented to identify materials procurement risks. This corroborates similar arguments by other researchers, for instance Kouvelis *et al.* (2012), that even though the Materials Procurement Risk Management field has significantly developed alongside the parent materials procurement management field, the literature pertaining to risk identification in materials procurement remains scant. Yet, identifying risks remains an important step in any risk management process. Researchers (Khan and Burnes, 2016) suggest that it is essential for any risk management approach to follow a systematic and formal approach of identifying, quantifying and reducing risks. Though the assessment of materials procurement vulnerability in today's complicated global economy is increasingly arduous, it is also vitally important (Sheffi, 2015). Arguing from this viewpoint, According to AbouRizk (2015), most of the construction industry research on materials procurement risk management has only described the problems and challenges, and has

rarely focused on analysing and quantifying the effects of using materials procurement management techniques on construction projects in the real world. According to their study of the literature, AbouRizk (2015) reported that materials procurement risk is the topic most addressed by the majority of the articles, as shown in Table 2.6. Although these articles comprised the largest percentage among risk studies, they have mainly used qualitative approaches rather than quantitative.

Table 2.6; Percentage of Articles According to Risk Type

Type of Risk	Percentage of articles in the literature
Strategic Risk	20%
Operations Risk	33%
Supply Chain Risk	47%

Source: AbouRizk (2012)

2.6 Risk Management Process in Materials Procurement

The process of managing risk is the bedrock that is attached to understanding as well as managing risks in project work. An efficient implementation of the process in a project requires the participation of all the steps in the process of risk management when dealing with risks. The risk management process consists of the main stages (Giannakis & Louis, 2011; Ubani *et al*., 2015 and Kuria & Kimutai, 2018).

There are a number of risks that can be identified in the construction industry and which can confront any construction project regardless of its size and scope. Due to the nature of the construction sector, risk management is very important. It is most widely used in projects with high level of uncertainty. These types of risk investments are characterized by more formal planning, monitoring and controlling processes. The easiest way to identify risk is to analyse and draw a conclusion from projects that have failed in the past. It is important to keep a balance in the concept of time-cost-quality trade off, which is

more widely becoming an important issue in the construction sector (Zhang & Xing, 2010).

As according to Ehsan *et al.* (2010) in order to undergo or perform a successful risk management within the construction industry, some factors have to be identified which are: the project risk i.e. in a risk management process, all the possible threats to the project must be identified; appropriate evaluation and analysis of risks can be decided early in order to help justify costly measures that will reduce risk level. It can also help decide if the risk can be avoided, shared or transferred.

Risk management involves four major processes as according to Ehsan *et al.* (2010). Some of the advantages of risk management include achievement of objectives, shareholders reliability, reduction of capital cost, less uncertainty and creation of value. Some of the limitations of risk management are, in case of wrong analysis or evaluation, time can be wasted trying to deal with risks that are not likely to occur; sometimes prioritizing risk management too highly could prevent from ever completing a project, especially when other works are suspended until after risk management process.

According to the Project Management Book of Knowledge (PMBOK, 2013), risk analysis involves the following processes, which are briefly discussed in the following sections;

1. Risk management planning
2. Risk identification
3. Risk assessment/analysis
    a. Qualitative risk analysis
    b. Quantitative risk analysis
4. Risk response planning
5. Risk monitoring and control

2.6.1 Risk management planning

The risk management process in construction begins with risk management planning; this phase outlines the strategy for achieving the objectives and goals for the process. During this phase, owner objectives, scope, and risk criteria are outlined. It is important to consider both the external environment (such as political, economic trends, and external stakeholder input) and internal environment (an organization's expectations and risk tolerance) to understand the overall project expectations. The project charter, risk management policies of the given party, roles and responsibilities, and the work breakdown structure, among other processes, are thoroughly investigated during this phase (Project Management Institute, 2010). It is imperative to understand the unique intentions, requirements and risk tolerance level of the given party for each project. The result of the risk planning phase is a document consisting of the risk management plan. This plan summarizes the information gained during this phase and creates an outline of the key plans and steps to follow for the remainder of the process.

2.6.2 Risk identification

Once the risk management plan is in place, the risk identification phase can begin. This is the primary phase in the process of managing risk, and it has to do with capturing all the risks that tend occurring in the course of the project (Nnadi *et al.,* 2018). This first stage lays the foundation for the succeeding steps of risk assessment and control as it is an eye-opener for organisations to understand inherent risk areas. When risk identification is done accurately, it guarantees effective managing of risk as it exposes hidden sources of losses that could escalate into incidences that could not be managed with unforeseen consequences (Ghasemi *et al.,* 2018). The outcome of not being able to identify positive risks is equal to the consequences of not identifying adverse risks (Fadun & Saka 2018).

Ideally, during this process, key project personnel, the risk management team, and experts in the area (both those affiliated with the project and not affiliated) attend a brainstorming session where all possible project risks can be recorded. During these brainstorming sessions, all risks should be incorporated, including those related to quality of work, efficiency, cost, and schedule (Al-Bahar & Crandall, 2012). This can then be supplemented with historical information from similar projects, especially documented projects consisting of lessons learned. Risks identified can be organized in terms of categories that best suit the given project, and the categories should strategically unify certain risks and help with the subsequent stages of risk management. The Project Management Institute (2010) provided examples of such categories, including "project management risks, organizational risks, and quality risks" (Project Management Institute, 2010). The risk identification process is ongoing for the duration of the project. As uncertainty decreases, such as when a project design becomes complete, the risks will become clearer. Risks should be adjusted constantly in the project.

2.6.3 Risk assessment/analysis

According to Kumar *et al.* (2018), assessing the identified risk is the following phase in the processes of managing risk after identification. Risk assessment is a process in which usable information is used in the determination of the frequency of occurrence as well as the degree of consequences in risk management (Olamiwale, 2014). Having identified all the risks in a project, the next thing to embark on is qualitative risk assessment which calls for additional analysis via investigating and estimation of the tendency of risk occurrence and its effect on each of the identified risk (Nnadi *et al.,* 2018). The different factors that require consideration at this stage include the impact of risk on the objectives of a project and how it can be managed. Others are the timing of an occurrence, the

probability of an event as well as its connection with other risks. Altogether, they give a proper understanding of each risk and facilitate a better response to each threat.

2.6.3.1 Qualitative risk analysis

Qualitative risk analysis refers to when risk factors are analysed in terms of their likelihood of occurrence on a project and the impact this occurrence would have on the project if the risk were to occur (Olamiwale, 2014). These factors are examined in the qualitative phase in terms of verbal expressions. This method lends itself best when utilizing expert opinions, as verbal expressions are often innate and understood by the general population. By examining each identified risk, the risks can be better understood. The quality of each risk determined in the risk identification phase can be assessed, and some may be omitted (Nnadi *et al.,* 2018). Risks can be organized in terms of importance based on the assessed impact and available methods of mitigation for a given risk. The first level of quantification described by the Construction Industry Institute (CII, 2012) involves enumerating the risk factors (or events) and then quantifying them by subjectively ranking them in terms of importance. The higher-ranked risks are then mitigated and managed on the project. Specialized tools and methods have been developed to examine risks in this way, and one such commonly used tool is the risk rating matrix (AbouRizk, 2015). This matrix combines the probability and the impact in order to understand the severity of the risk and the actions that should be taken. For example, if a risk is very likely to occur and the impact would be disastrous, this would mean that the risk is intolerable for the project.

Measures would either have to be taken to eliminate this risk, or the project might be terminated, depending on the risk tolerance of the decision-maker. While some parties are willing to take a great deal of risk, others may draw the line much sooner. Once a qualitative assessment of risks has been completed, there is generally a good

understanding of the most important risks that will affect the project. At this point, certain decisions can be made. Based on analysis it is known that most risks occur in one particular location of the project. Redesign of this area may be a possibility and could be investigated. Likewise, a different method of construction may be chosen based on the number of risks impacting the project. In order to gain a further understanding of the cost and schedule impacts that risks will have on a project, quantitative analysis usually follows.

2.6.3.2 Quantitative risk analysis

Quantitative risk analysis (QRA) uses the results determined during qualitative analysis and turns them into quantifiable information that can be useful for the project. This is generally done by assigning probability and impact scores to the verbal expressions and multiplying them together in order to gain a value for risk severity (Construction Industry Institute, 2012).

Quantitative analysis can occur for both costs and scheduling. Quantitative analysis of schedules can be performed using techniques such as Project Evaluation and Review Techniques (PERT) analysis or Monte Carlo Simulation of CPM networks. Quantitative analysis of cost utilizes the work breakdown structure, an analysis of the estimate often using Monte Carlo simulation, or other analytical techniques. Galway (2014) found that the common consensus among users of risk analysis is that it is valuable and desired. Still, empirical studies appear to be almost non-existent in this area.

2.6.4 Risk response planning

Based on the established risks, risk response planning involves determining the optimal method of mitigation (Project Management Institute, 2010). Response planning may directly follow the qualitative phase, or continue after quantification. This depends on what is defined in Phase 1 (risk planning), as goals will vary based on the project. The

risk-response planning phase involves determining how to avoid a risk; for example, changing portions of the design or undertaking a new process, which can help to reduce a risk (Kremljak, 2014). Such methods are usually derived through a workshop setting and conducted in a hierarchical manner (with risks most dangerous to the project being addressed first). Historical data can also help to determine the most effective ways to avoid a risk.

2.6.5 Risk monitoring and control

Risk monitoring and control, the final phase in risk management, involves continual inspection, examination, review, and observation in order to determine if any changes or unexpected outcomes have occurred and ensure that the established goals are being met (ISO, 2011). This is often done by having a designated individual or group of individuals who are dedicated to checking on the process through interviews with the appropriate people, on-site checks, consistent reporting, and thorough documentation of events.

According to Kremljak (2014), managers in industries, governmental and private organizations deal with great level of uncertainties in their decision. He argues that managers have incomplete data on future happenings or events; they lack knowledge of all possible alternative and consequences of all likely decisions. Finally, he concluded that addressing uncertainty involves creating experimental tools which can bring acceptable solutions.

2.7 Risk Response Strategies in Materials Procurement

After the risk has been identified and evaluated, the project team develops a risk mitigation plan, which is a plan to reduce the impact of an unexpected event. Risk mitigation in projects means taking steps to reduce adverse effects or a systematic reduction in the extent of exposure to a risk and the likelihood of its occurrence (Brooks, 2014). According to Chepa *et al.* (2015), risk response must revolve around following

response strategies to ensure minimization of the paraphernalia of uncertain events. Doing this will facilitate project continuity and ensure disaster recovery. According to Kremljak (2014), risks can be handled through the following methods:

1. Risk avoidance
2. Risk sharing
3. Risk reduction
4. Risk transfer
5. Risk retention

Each of these mitigation techniques can be an effective tool in reducing individual risks and the risk profile of the project. The risk mitigation plan captures the risk mitigation approach for each identified risk event and the actions the project management team will take to reduce or eliminate the risk (Chepa *et al.*, 2015).

2.7.1 Risk avoidance

Risk avoidance means stopping any activity that could carry risk. It is the answer to all risk but might lose potential gain attached to a specific risk. It involves eliminating any process that may cause risk towards achieving our objective independent of the gain it may bring e.g. withdrawal from a business so as to avoid loss (Kremljak, 2014).

This usually involves developing an alternative strategy that has a higher probability of success but usually at a higher cost associated with accomplishing a project task. A common risk avoidance technique is to use proven and existing technologies rather than adopt new techniques, even though the new techniques may show promise of better performance or lower costs (Chepa *et al.,* 2015). A project team may choose a vendor with a proven track record over a new vendor that is providing significant price incentives to avoid the risk of working with a new vendor. The project team that requires drug testing

for team members is practicing risk avoidance by avoiding damage done by someone under the influence of drugs.

2.7.2 Risk sharing

In this process the risk is been shared with another party which means the loss burden or the benefit attached to it will be shared between the parties. In some cases, insurance is used so as to transfer the risk to a third party, but in case of default the original risk will likely revert to the first party (Kremljak, 2014).

This involves partnering with others to share responsibility for the risk activities. Many organisations that work on international projects will reduce political, legal, labour, and others risk types associated with international projects by developing a joint venture with a company located in that country (Chepa *et al.*, 2015). Partnering with another company to share the risk associated with a portion of the project is advantageous when the other company has expertise and experience the project team does not have. If the risk event does occur, then the partnering company absorbs some or all of the negative impact of the event. The company will also derive some of the profit or benefit gained by a successful project.

2.7.3 Risk reduction

It means reducing the extent of the loss or possibility of loss. Here, we find a balance between negative effect of risk and the benefits attached to the process (Kremljak, 2014). Modern software's have been developed which help with in this process.

This is an investment of funds to reduce the risk on a project. On international projects, companies will often purchase the guarantee of a currency rate to reduce the risk associated with fluctuations in the currency exchange rate. A project manager may hire an expert to review the technical plans or the cost estimate on a project to increase the confidence in that plan and reduce the project risk (Chepa *et al.*, 2015). Assigning highly

skilled project personnel to manage the high-risk activities is another risk reduction method. Experts managing a high-risk activity can often predict problems and find solutions that prevent the activities from having a negative impact on the project. Some companies reduce risk by forbidding key executives or technology experts to ride on the same airplane.

2.7.4 Risk transfer

This is a risk reduction method that shifts the risk from the project to another party. The purchase of insurance on certain items is a risk transfer method. The risk is transferred from the project to the insurance company (Chepa *et al.*, 2015). A construction project in the Caribbean may purchase hurricane insurance that would cover the cost of a hurricane damaging the construction site. The purchase of insurance is usually in areas outside the control of the project team. Weather, political unrest, and labour strikes are examples of events that can significantly impact the project and that are outside the control of the project team.

2.7.5 Risk Retention

By default, all risks are retained if not avoided or transferred. This involves accepting the loss or benefit of gain from a specific risk. Mostly in this kind of situation the cost of managing the risk is far more than the negative effect of the risk (Kremljak, 2014). This include risks that are so large that cannot be insured against and premium would be infeasible e.g. war.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

Design in research is the overall plan for connecting the conceptual research problems to the pertinent empirical research. It articulates what data is required, what methods are going to be used to collect and analyse the data (Van-Wyk,&Toale 2015). It also constitutes the measurement of analysis and collection of data. Clearly research problem determines the type of research design (Ali, 2017). This study adopted a survey design approach using quantitative data. Survey design was suitable for this study because the factors considered are those identified from the literature to which their applicability in construction project is to be verified in this study. Data was collected through structured questionnaire administered to respondents within Abuja, the Federal Capital Territory (FCT) of Nigeria. Abuja was selected because is one of the epicenter of construction activities in Nigeria.

The methods used in carrying out this research can be classified into two parts. The first part involved carrying out a review of past literature i.e. journals, a seminar paper, conference papers, textbooks, materials from the internet. The literature review helped in identifying contributions of various authors on the topic in question providing a basis for further investigation.

The second method involved a survey design approach using a well-structured questionnaire which was based on the information from the literature review.

3.2 Research Population

A research population is generally a large collection of individuals or objects that is the main focus of a scientific query (Mohamed, 2017). Merriam-Webster (2018) dictionary

defines population in research as the whole number of people or inhabitants in a country or region from which a sample can be drawn. The unit of analysis may be a person, group, organization, country, object, or any other entity that you wish to draw scientific inferences about (Isatolo, 2017). The targeted population for this research constitutes the major construction participants (Procurement officers, Project managers, Site managers and Contractors) within Abuja, the Federal Capital Territory. The population of this research constitutes 62 active building construction projects sites in Abuja, Nigeria gotten from Federation of Construction Industry in Nigeria (FOCI, 2019) directory which states that there are 31 registered firms in Abuja.

3.3 Sample Frame

This is the process of defining the population, a selection of a representative of the population. This is an accessible section of the target population (usually a list with information) from where a sample can be drawn (Loke, 2013).

A sample is a limited number of observations from a population. Usually the sample is drawn because it is impossible to cover all observations in a population on grounds of time or expense (Research Lifeline, 2012). The type of understanding sought by qualitative interpretivists demands great flexibility in the data analysis process, as it does in the design and data collection phase.

The sample frame was 62 actives sites of the 31 registered firms that are located and operating within Abuja were broken into sample frame constituting one each of the following respondents: Procurement Officers, Project Managers, Site Managers and Contractors making a total of 248 respondents within the study area. These respondents were selected because they are the key players in managing materials procurement risks in building projects.

3.4 Sample Size

A sample size is the number of data sources that are actually selected from the total population (Megha & Rajiv, 2013). Because of large number of the population size (248), the number was subject to Taro Yamane formula for finite population (Ojo, 2010). The number was then reduced to 153 at 5 percent limit of error and at 95 percent confidence level.

The formula is stated as: $n = \frac{N}{1+N(e)^2}$

Where: n = the required sample size; N = the finite population size; e = the level of significance in this case 0.05 was used; and 1= the unit.

$\frac{248}{1+248(0.05)^2} = 153$

For the purpose of this research, the sample size was 153 respondents.

3.5 Sampling Technique

The two main extremes of the sampling technique, according to Laerd Dissertation(2012) are the probability and the non-probability sampling. Probability sample require that every member of the population has a known and non-zero chance of being selected in the sample (Laerd Dissertation, 2012)

In order to guarantee equal representation for each of the identified groups of professionals in the population, stratified random sampling method was adopted for the research. The respondents were first categorized into different strata/groups, that is: procurement officers, project managers, site managers and contractors and they were selected and randomly sampled accordingly.

3.6 Method of Data Collection

Research data can either be primary or secondary in nature. Primary data are raw data, gotten through the use of questionnaire, interview or observation, or the combination of any of these research tools. It is extracted directly from the various sources such as the respondent and the area(s) under study. Secondary data are the processed information and kept in record for different purposes. They exist in published materials and are merely collected for the purpose of research (SAGE Research Methods, 2010). This study employed the use of primary data which was collected through the use of a well-structured questionnaire administered to selected construction firms registered with FOCI directory in Abuja.

3.7 Data Collection Instrument

For the purpose of this research, a well-structured questionnaire was used to gather information from the selected construction firms registered with FOCI directory in Abuja. A primary data source is an original data source, that is, one in which the data are collected firsthand by the researcher for a specific research purpose or project (SAGE Research Methods, 2010). A multi-choice type questionnaire was designed for this research. The questionnaire contained tables and check-boxes for easy selection of options by respondents. The questionnaires were structured in a manner that allows respondents to select from the answer choices provided. The questionnaire reflected the major areas of the study interest, thereby, providing information relevant to the study objectives and answering the research questions. The questionnaires were on a 5-point Likert scale.

The questionnaire was divided into five (5) main parts. Part A - is related to demographic information of the respondents and their companies. Part B - asked questions about the inherent materials procurement risk factors in building projects. Part C - asked questions on the effect of the materials procurement risks on time, cost and quality performance of

building projects. Part D - asked questions about the strategies for mitigating materials procurement risks in building construction projects.

Moreover, interviews were conducted with procurement officers, project managers, site managers and contractors and questions were asked on about risks management processes.

3.8 Method of Data Analysis

In order to achieve the aim of this research, the descriptive method of analysing data was employed and this ranged from the use of percentile, frequency, Mean Item Score (MIS), Relative Importance Index (RII) and Thematic/Deductive Methods. Data processing was done with the aid of Statistical Package for the Social Sciences (SPSS 23) software version.

3.8.1 Percentile

These are ratios multiplied by 100. It helps in rating a number of factors according to the degree of occurrence attached to them. The higher the percentage ratings, the higher the important or significance attached to factors. The essence of percentile is to allocate a value between 0 and 100 to a factor (where 100 is the highest possible value) using factor size and the total size (Pallant, 2005).

The formula is $$P = \frac{n\,x\,100}{N}$$

Where “P” is the percentage of the factor, “n” is the size of the factor in consideration and “N” is the total size or population. This method of analysis will be employed in analysing the background information of the respondents.

3.8.2 Mean Item Score (MIS)

This method of analysis was employed for different aspects of the study. In examining the effect of the materials procurement risks on time, cost and quality performance of building projects, identifying the risks management processes of materials procurement in building construction projects, MIS was employed. MIS was used for two purposes, that is, ranking and determination of significance of different factors of the data to be collected. The premise of decision for the ranking is that the factor with the highest mean item score is ranked 1st and others in such subsequent descending order.

Since a Likert of 5-point scale was employed for the collection of data, the formula for mean item score is written as:

$$\text{MIS} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n_5 + n_4 + n_3 + n_2 + n_1}$$

Where n is the frequency of each of the rankings, and

n_1 = number of respondents who answered “not applicable” or “strongly disagree”

n_2 = number of respondents who answered “low” or “disagree”

n_3 = number of respondents who answered “moderately applicable” or “indifferent”

n_4 = number of respondents who answered “applicable” or “agree”

n_5 = number of respondents who answered “highly applicable” or “strongly agree”

3.8.3 Relative Importance Index (RII)

The relative importance index was adopted different aspects of the study. In determining the importance of risk factors in materials procurement and also to determine the materials procurement risk mitigating strategies. RII was used for two purposes, that is, ranking

and determination of significance of different factors of the data to be collected. The premise of decision for the ranking is that the factor with the highest mean item score is ranked 1st and others in such subsequent descending order.

The Relative Importance Index (RII) according to Megha and Rajiv (2013) is written as:

$$RII = \frac{\sum W}{A*N}$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight, and N is the total number of respondents.

The analysed data were presented in tables. Table 3.1 shows the procedures adopted in treating each objectives which comprise of sampling tools and method of analysis.

Table 3.1; Procedures for treating the research objectives

S/n	Objectives	Data tools	Methods of data analysis
1	Examine the inherent materials procurement risk factors in building projects	Questionnaire	Relative Important Index and Ranking Method
2	Examine the effect of the materials procurement risks factors on time, cost and quality performance of building projects	Questionnaire	Mean Item Score and Ranking Method
3	Determine strategies for dealing with materials procurement risks factors on performance of building construction projects	Questionnaire	Mean Item Score and Ranking Method

Source: Researcher's Construct, 2020

3.8.4 Decision rules for the Likert scales used

The outcome of Mean Item Score (MIS) on a Five-Points Likert scale could be decided on the following; 4.50-5.00 for Very High; 3.50-4.49 for High; 2.50-3.49 for Moderate; 1.50-2.49 for Little; 0.1-1.49, and Very Little. This was adapted and converted to RII on a scale 0 to 1.

Table 3.2; Decision Rule for determining the inherent materials procurement risk factors in building projects

SN	Cut-off Point for MIS 5-Points	Cut-off Point for RII 5-Points	Decision
1	4.50-5.00	0.90-1.00	Very High (VH)
2	3.50-4.49	0.70-0.89	High (H)
3	2.50-3.49	0.50-0.69	Moderate (M)
4	1.50-2.49	0.30- 0.49	Little (L)
5	0.1-1.49	0.10-0.0.29	Very Little (VL)

Source: Adapted from Morenikeji, 2006.

3.9 Reliability and Validity Tests

The Cronbach's Alpha Test for Reliability and validity was carried out on the collected data and the result is shown on table 3.3. Reliability of a research instrument is the measures of the accuracy and precisions of the adopted measurement procedure, this test gives the cronbach alpha value which is not be less than 0.50. For example, Oyedele *et al.* (2015) was of the opinion that an alpha value of 0.7 and above implies better and higher reliability and consistency of the research instruments. The Cronbach's alpha value of the variables tested ranges between 0.801-0.705, with an average of 0.747, thus revealing that the questionnaire, data collected are reliable and valid.

Table 3.3; Cronbach's Alpha Reliability Statistics

Variables tested	Cronbach's Alpha	N of Items
Material Procurement risks factors	0.735	49
Effect of material procurement risks factors on time, cost and quality	0.705	49
Material Procurement risk mitigation strategies	0.801	49

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Demographic Information of the Respondents

Table 4.1 shows the analysis of the respondents' demographic information. The analysis shows that the total number of questionnaires retrieved was 139 and most of the respondents sampled (77.59%) are males while 22.41 % are females. In terms of professionals' representation, the result revealed that contractors (40.07%) are more, followed by procurement officers (23.15%), then site managers (13.89%) and lastly project managers (13.89%). A look at the year of work experience of the respondents shows that only 15.74% of them have their year of working experience to fall within less than 5 years range, while 27.78% and 33.33% falls between the range of 5 to 10 and 11 to 20 years respectively. Also 17.59% and 5.56% of the population falls between the ranges of 21 to 30 years and above 30 years respectively. However, the average years of working experience of the respondents is calculated as approximately 10.75 years. This implies that they are experienced enough to give a valid response.

In terms of academic qualification, the highest is BSc/Mtech (53.70%), followed by HND (21.30%), then MSc./Mtech (12.96%), ND and Others are 5.56% and 6.48% respectively.

Based on the result on the respondents' background information, it was concluded that the respondents are well equipped professionally and in terms of experience to give reasonable insight in the subject under consideration.

Table 4.1; Demographic Information of the Respondents

	Variables	Frequency	Valid percent
Gender	Male	107	77.59%
	Female	32	22.41%
	Total	**139**	**100%**
Profession	Contractors	56	40.07%
	Procurement officers	33	23.15%
	Site managers	31	22.89%
	Project managers	19	13.89%
	Total	**139**	**100%**
Years of Experience	Less than 5years	21	15.74%
	5-10years	39	27.78%
	11-20years	46	33.33%
	21-30years	25	17.59%
	Above 30	8	5.56%
	Total	**139**	**100%**
Academic qualification	ND	8	5.56%
	HND	30	21.30%
	BSc/Btech	75	53.70%
	MSc/Mtech	17	12.96%
	Others	9	6.48%
	Total	**139**	**100%**

Source: Researcher's Field survey, 2020

4.2 Inherent Materials Procurement Risk Factors in Building Projects

A total of forty (40) risk factors were identified from literature and respondents were asked to rank these building materials procurement risks based on their frequency of occurrence. Table 4.2 shows the result of the analysis of the inherent materials procurement risk factors in building project. It can be seen that the top five (5) building materials procurement risks in terms of occurrence are: Inflation; Third party delay and default; Uncertain research and development results; Ineffectiveness of arrangements; and Shortage of raw materials and Quality/excessive snagging, with RII values of 0.91, 0.81, 0.80, 0.80 and 0.79s respectively. The least five (5) building materials procurement risks in terms of occurrence are: Force majeure, Incompetency of project team, Difficulties/delays in availability of materials, equipment and labour, Bureaucratic problems, Site access/right of ways; Delay in design/redesign if over budget,

Exceptionally inclement weather; and Financial failure-any party with RII values of 0.72s, 0.68, 0.68 and 0.63 respectively. This shows that all factors considered were considered high because they fall between the RII values of 0.79 - 0.91 respectively.

However, a close look at the result in the Table 4.2 shows that all the identified 40 building materials procurement risks factors had an average RII value of 0.75. This implies that to a considerable extent all the 40 building materials procurement risks have the tendency to occur in building projects.

Table 4.2; Inherent materials procurement risk factors in building project

S/No	Materials procurement risk factors	RII	Rank	Decision
1.	Inflation	0.81	1	High
2.	Third party delay and default	0.81	1	High
3.	Uncertain research and development results	0.80	3	High
4.	Ineffectiveness of arrangements	0.80	3	High
5.	Shortage of raw materials	0.79	5	High
6.	Quality/excessive snagging	0.79	5	High
7.	Experience of subcontractors	0.78	7	High
8.	Site impact on local community	0.77	8	High
9.	Inadequate specifications	0.77	8	High
10.	Unexpected changes in demand	0.76	10	High
11.	Security	0.76	10	High
12.	Permit and approval	0.76	10	High
13.	Owner and contractor experience	0.76	10	High
14.	Differing site conditions (unforeseen site conditions)	0.76	10	High
15.	Policy changes	0.75	**15**	High
16.	New and existing competitors	0.75	15	High
17.	Changes in interest rates	0.75	15	High
18.	Inappropriate design for scheme	0.75	15	High
19.	Incompetency of site management	0.75	15	High
20.	Volatility of supply chain workflow	0.74	20	High
21.	New technology or technique	0.74	20	High
22.	Inflexible design	0.74	20	High
23.	Responsiveness of suppliers	0.74	20	High
24.	Changes in quantity/scope of work	0.74	20	High
25.	Quality control and assurance	0.74	20	High
26.	Fluctuations in prices	0.73	26	High
27.	Bad debt	0.73	26	High
28.	Labour uncertainties (for instance strikes)	0.73	26	High
29.	Frequent changes in supply chain inputs	0.73	26	High
30.	Fragmented decision-making	0.73	26	High
31.	Inconsistency of suppliers	0.73	26	High
32.	Design changes	0.73	26	High
33.	Natural occurrences for instance fire	0.72	33	High
34.	Incompetency of project team	0.72	33	High
35.	Difficulties/delays in availability of materials, equipment and labour	0.72	33	High
36.	Bureaucratic problems	0.72	33	High
37.	Site access/right of ways	0.72	33	High
38.	Delay in design/redesign if over budget	0.68	38	Moderate
39.	Exceptionally inclement weather	0.68	38	Moderate
40.	Financial failure-any party	0.63	40	Moderate
	General Average	**0.75**		**High**

Source: Researcher's Field survey, 2020

4.3 Effect of the materials procurement risks factors on time, cost and quality performance of building projects

Table 4.3 shows the materials procurement risk factors that have high effect on time performance of building project are: Inflexible design (MIS=3.99); New and existing competitors (MIS=3.95); Unexpected changes in demand (MIS=3.92); Inappropriate design for scheme (MIS=3.83); Bad debt (MIS=3.80); Design changes (MIS=3.71); Inadequate specification (MIS=3. 3.66); Shortage of raw materials (MIS=3. 3.65); Force majeure (MIS=3. 3.64); and Delay in design/redesign if over budgeted (MIS=3. 3.54).

Table 4.3; Effect of the materials procurement risks factors on time performance of building projects

S/No	Time performance risk factors	MIS	Rank	Decision
1.	Inflexible design	3.99	1	Very High
2.	New and existing competitors	3.95	2	Very High
3.	Unexpected changes in demand	3.92	3	Very High
4.	Inappropriate design for scheme	3.83	4	Very High
5.	Bad debt	3.80	5	Very High
6.	Design changes	3.71	6	Very High
7.	Inadequate specification	3.66	7	Very High
8.	Shortage of raw materials	3.65	8	Very High
9.	Force majeure	3.64	9	Very High
10.	Delay in design/redesign if over budget	3.54	10	Very High
11.	Responsiveness of suppliers	3.53	11	Very High
12.	Volatility of supply chain workflow	3.53	11	Very High
13.	Exceptionally inclement weather	3.51	13	Very High
14.	Incompetency of project team	3.49	14	High
15.	Policy changes	3.46	15	High
16.	Permit and approval	3.45	16	High
17.	Ineffectiveness of arrangements	3.39	17	High
18.	Bureaucratic problems	3.36	18	High
19.	Incompetency of site management	3.32	19	High
20.	Inconsistency of suppliers	3.18	20	High
21.	Difficulties/delays in availability of materials, equipment and labour	3.14	21	High
22.	Site access/right of ways	3.00	22	High
23.	Financial failure-any party	3.00	23	High
24.	Differing site conditions (unforeseen site conditions)	3.00	24	High
25.	Experience of subcontractors	2.96	25	High
26.	Third party delay and default	2.71	26	High
27.	Owner and contractor experience	2.57	27	High
28.	Changes in quantity/scope of work	2.36	28	Moderate

Source: Researcher's Field survey, 2020

Table 4.4 shows that the materials procurement risk factors that have high effect on cost performance of building project are: Inflation (MIS=3.99); Quality control and assurance (MIS=3.90); New technology or technique (MIS=3.89); Difficulties/delays in availability of materials, Equipment and labour (MIS=3.87); Security (MIS=3.80); Labour unrest (MIS=3.79); Bureaucratic problems (MIS=3.76); Fluctuations in prices (MIS=3.75);

Owner and contractor experience (MIS=3.74); and Changes in quantity/scope of work (MIS=3.73).

Table 4.4; Effect of the materials procurement risks factors on cost performance of building projects

S/No	Cost performance risk factors	MIS	Rank	Decision
1.	Inflation	3.99	1	Very High
2.	Quality control and assurance	3.90	2	Very High
3.	New technology or technique	3.89	3	Very High
4.	Difficulties/delays in availability of materials, Equipment and labour	3.87	4	Very High
5.	Security	3.80	5	Very High
6.	Labour uncertainties (for instance strikes)	3.79	6	Very High
7.	Bureaucratic problems	3.76	7	Very High
8.	Fluctuations in prices	3.75	8	Very High
9.	Owner and contractor experience	3.74	9	Very High
10.	Changes in quantity/scope of work	3.73	10	Very High
11.	Changes in interest rates	3.71	11	Very High
12.	Bad debt	3.67	12	Very High
13.	Frequent changes in supply chain inputs	3.51	13	Very High
14.	Policy changes	3.47	14	High
15.	Force majeure	3.41	15	High
16.	Design changes	3.38	15	High
17.	New and existing competitors	3.38	17	High
18.	Uncertain research and development results	3.37	17	High
19.	Differing site conditions (unforeseen site conditions)	3.37	19	High
20.	Changes in quantity/scope of work	3.27	20	High
21.	Shortage of raw materials	3.24	21	High
22.	Site impact on local community	3.19	22	High
23.	Unexpected changes in demand	3.14	23	High
24.	Inadequate specifications	3.09	24	High
25.	Financial failure-any party	2.99	25	High

Source: Researcher's Field survey, 2020

Table 4.5 shows that the materials procurement risk factors that have high effect on the quality performance of building project are: Differing site condition (unforeseen ground conditions) (MIS=3.96); Changes in interest rates (MIS=3.95); Incompetency of site management (MIS=3.91); Responsiveness of suppliers (MIS=3.91); Quality control and assurance (MIS=3.87); Inflexible design (MIS=3.82); Inconsistency of supplies (MIS=3.81); Bad debt (MIS=3.75); Changes in quantity/scope of work (MIS=3.75); Force majeure (MIS=3.74).

Table 4.5; Effect of the materials procurement risks factors on quality performance of building projects

S/No	Quality performance risk factors	MIS	Rank	Decision
1.	Differing site condition (unforeseen ground conditions)	3.96	1	Very High
2.	Changes in interest rates	3.95	2	Very High
3.	Incompetency of site management	3.91	3	Very High
4.	Responsiveness of suppliers	3.91	3	Very High
5.	Quality control and assurance	3.87	5	Very High
6.	Inflexible design	3.82	6	Very High
7.	Inconsistency of suppliers	3.81	7	Very High
8.	Bad debt	3.75	8	Very High
9.	Changes in quantity/scope of work	3.75	8	Very High
10.	Force majeure	3.74	10	Very High
11.	Incompetency of project team	3.71	11	Very High
12.	Shortage of raw materials	3.69	12	Very High
13.	Experience of subcontractors	3.69	12	Very High
14.	Unexpected changes in demand	3.67	14	Very High
15.	Quality/excessive snagging	3.67	14	Very High
16.	Labour uncertainties (for instance strikes)	3.66	16	Very High
17.	Frequent changes in supply chain inputs	3.65	17	Very High
18.	Inadequate specifications	3.60	18	Very High
19.	Owner and contract experience	3.58	19	Very High

Source: Researcher's Field survey, 2020

4.4 Strategies for dealing with materials procurement risks in building construction projects.

Table 4.6 shows the analysis of the data gathered on the materials procurement risks response strategies in building construction projects. It can be seen that the most important response strategies for Risk Avoidance carried out in the process of dealing with building materials procurement risks are: Eliminating the cause of the risk; and Reducing the scope of the contract with MIS values of 4.81 and 4.78 respectively. The least strategy is: Using a proven approach instead of a new one with MIS value of 3.76.

For Risk Transfer, the important dealing with are: Allocating risks to other entities e.g. outsourcing; and Buying insurance to cover any financial loss should the risk become reality with MIS values of 4.68 and 4.29 respectively. The least important response is: It comes with additional costs, such as the cost of insurance or additional amount tacked on to the pricing by the contractor in order to deal with the event when it occurs with MIS value of 3.74.

For Risk Reduction, the top five (5) most important response are: Policies design to reduce risk; Error tolerant design-user interfaces that prevent human error from having serious consequences; Due diligence- Investigation process before committing to a contract; Validation of information before it is accepted by system; and Establishing standards to guide procurement practices and decision making with MIS values of 4.76, 4.21, 4.10, 4.07 and 4.05 respectively. The least important responses are: Compliance training for procurement employee design to reduce compliance and reputational risks; and System testing- is a core risks reduction technique with MIS values of 3.44 and 3.21 respectively.

For Risk Acceptance, the top most important responses are: Developing a contingency plan for execution should the risk event occur with MIS value of 3.83 and the least important response is: Accept the consequences of the risk event (when it occurs) with MIS value of 3.56.

The overall top ten (10) important strategies for dealing with procurement risks are: Eliminating the cause of the risk (MIS=4.81), Reducing the scope of the contract (MIS=4.78), Policies design to reduce risk (MIS=4.76), Avoiding contractor with unproven track record (MIS=4.71), Allocating risks to other entities e.g. outsourcing (MIS=4.68), Buying insurance to cover any financial loss should the risk become reality (MIS=4.29), Error tolerant design-User interfaces that prevent human error from having serious consequences (MIS=4.21), Due diligence- Investigation process before committing to a contract (MIS=4.10), Validation of information before it is accepted by system (MIS=4.07), and Establishing standards to guide procurement practices and decision making (MIS=4.05).

The least important strategies for dealing with building materials procurement related risks are: Deciding to deal with the risks and their consequences when or if they occur but not planning for them in advance (MIS=3.72), Controls built in to process such as approvals designed to reduce procurement risks (MIS=3.65), Accept the consequences of the risk event (when it occurs) (MIS=3.56), Compliance training for procurement employee design to reduce compliance and reputational risks (MIS=3.44), and System testing- is a core risk reduction techniques (MIS=3.21).

However, a close look at the result in the Table 4.6 shows that all the identified strategies for mitigating building materials risks have a mean score of above average of 3.0. This implies that to a considerable extent all the twenty-two strategies have the tendency of influencing the performance of material waste minimisation process.

Table 4.6; Materials procurement risks response strategies in building construction projects.

S/No	Procurement risk response strategies	MIS	Rank	Overall Rank
A	**Risk avoidance (Doing something else or take a different route)**			
1	Eliminating the cause of the risk-	4.81	1	1
2	Reducing the scope of the contract	4.78	2	2
3	Avoiding contractor with unproven track record	4.71	3	4
4	Adding resources or time to the contract	3.96	4	13
5	Using a proven approach instead of a new one.	3.76	5	18
B	**Risk Transfer (Sharing)**			
1	Transferring particular risks to the contractor through negotiation might be better	3.96	1	13
2	It comes with additional costs, such as the cost of insurance or additional amount tacked on to the pricing by the contractor in order to deal with the event when it occurs.	3.74	2	19
3	Allocating risks to other entities e.g. outsourcing	4.68	3	5
4	Buying insurance to cover any financial loss should the risk become reality	4.29	4	6
C	**Risk Reduction (Optimize-mitigate)-**Doing something to reduces the impact or probability of a risk			
1	Policies design to reduce risk	4.76	1	3
2	Error tolerant design-User interfaces that prevent human error from having serious consequences	4.21	2	7
3	Due diligence- Investigation process before committing to a contract.	4.10	3	8
4	Validation of information before it is accepted by system	4.07	4	9
5	Establishing standards to guide procurement practices and decision making	4.05	5	10
6	Verifying information with Authoritative information sources	4.02	6	11
7	Review of decisions and implementations by experts can reduce risks	4.01	7	12
8	Communication-communicating risk may serve to reduce it	3.94	8	15
9	Contingency plans- Planning for critical situations can reduce the impact of such events should they occur	3.84	9	16
10	Process improvements such as automating steps to reduce errors	3.74	10	19
11	Controls built in to process such as approvals designed to reduce procurement risks	3.65	11	22
12	Compliance training for procurement employee design to reduce compliance and reputational risks	3.44	12	24
13	System testing- is a core risk reduction techniques	3.21	13	25
D	**Risk Acceptance (Do nothing)**			
1	Developing a contingency plan for execution should the risk event occur	3.83	1	17
2	Deciding to deal with the risks and their consequences when or if they occur but not planning for them in advance	3.72	2	21
3	Accept the consequences of the risk event (when it occurs)	3.56	3	23

Source: Researcher's Field survey, 2020

4.5 Discussion of Results

The study revealed that inherent building materials procurement risks in building projects are: Inflation; Third party delay and default; Uncertain research and development results; Ineffectiveness of arrangements; and Shortage of raw materials and Quality/excessive snagging. These findings are in line with the conclusion of Chacon *et al.* (2011) and Saha (2015).

The study found that building materials procurement risks with high effect on cost, time and quality performance of building projects are: Inflexible design, New and existing competitors, Bad debt, Inflation, Quality control and assurance, Security, Differing site condition and Changes in interest rates. These findings are in line with the conclusion of Helbing *et al.* (2016).

It was found that the most important materials procurement risk response strategies for building projects are: Eliminating the cause of the risk, Reducing the scope of the contract, Adding resources or time to the contract, Avoiding contractor with unproven track record, Using a proven approach instead of a new one, Communication-communicating risk may serve to reduce it, Contingency plans- Planning for critical situations can reduce the impact of such events should they occur, Error tolerant design-User interfaces that prevent human error from having serious consequences, Due diligence- Investigation process before committing to a contract, and Policies design to reduce risk. These findings are in line with the conclusion of Chepa *et al.* (2015)

4.6 Summary of the Research Findings

The major findings of this research are summarised as follows:

1. The inherent building materials procurement risks are: Inflation; Third party delay and default; Uncertain research and development results; Ineffectiveness of arrangements; and Shortage of raw materials and Quality/excessive snagging.
2. The building materials procurement risks that have high effect on building project are: for cost performance this includes; Inflexible design; Unexpected changes in demand; Bad debt. For time performance; Inflation; Quality control and assurance; Security and for quality performance; Differing site condition (unforeseen ground conditions); Responsiveness of suppliers; Quality control and assurance.
3. The most important building materials procurement risk response strategies include: Reducing the scope of the contract; Adding resources or time to the contract; Avoiding contractor with unproven track record, using a proven approach instead of a new one; Contingency plans; Error tolerant design-user interface; Due diligence; and Policies design to reduce risk.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion for the Study

The study was set out to explore the inherent buildings materials procurement risks factors on the performance of building projects are: inflation; third party delay and default; uncertain research and development results; ineffectiveness of arrangements; shortage of raw materials and quality/excessive snagging.

The study concludes that the building materials procurement risks that impact more on cost, time and quality performance of building project are: Inflexible design; unexpected changes in demand; bad debt; inflation; quality control and assurance; security; differing site condition; responsiveness of suppliers; and quality control and assurance.

The study concludes that the most important building materials procurement risk response strategies include: reducing the scope of the contract; adding resources or time to the contract; avoiding contractor with unproven track record, using a proven approach instead of a new one; contingency plans.

5.2 Recommendations by the Study

From the findings, the study makes the following recommendations:

1. A competent procurement officers having good pricing and negotiation skills be appointed for building material procurement on construction sites in order to avoid risks such as: inflation; third party delay and default; uncertain research and development results.
2. To prevent risks that have more impact on cost. Time and quality, the contractor ought to create contract provisions and project processes to create a clear

expectation of the temporal requirements for planning, producing, and managing the project.

3. The contractor should always conduct due diligence before the contract is signed to check that the supplier does not have any major compliance or quality system failures that could affect the company's ability to build top-quality projects.

5.3 Contributions to Knowledge

From the findings, the following are the contribution of the research to knowledge:

1. The study has contributed in deepening the knowledge of building materials procurement risks in building projects.

2. The impact of building materials procurement risks on project performance and key project measurement parameters were found and this could help key decision makers in coming up decisions to avoiding these risks.

3. Delay in times, cost overruns, and poor quality of work caused by risks in building materials procurement will be tackled better in future projects especially were there records (historical data).

4. The study has also added to the existing body of knowledge available on building materials procurement and risks in the construction industry.

5.4 Area for Further Research

The study recommends the following further research;

1. To assess the concept's compatibility, relevance and significance to other sectors and industries.
2. To assess supplier's delivery performance on time, cost and quality.
3. Assess on optimisation techniques to demonstrate the trade-off between building materials procurement financial performance and risk mitigation.
4. To developed a framework for managing building materials procurement risks in construction projects.

REFERENCES

AbouRizk, S. M. (2015). Risk Analysis for Construction Projects: A practical guide for engineers and project managers. Edmonton: *NSERC Industrial Research Chair in Construction Engineering and Management*, 7(1):47-52.

Aibinu, A. A., & Odeyinka, H.A. (2016). Construction delays and their causative factors in Nigeria. *Journal of Construction and Management*, 132(7):667-677.

Al-Bahar, J., & Crandall, K. (2012). Systematic Risk Management Approach for Construction Projects. *Journal of Construction Engineering and Management*, 8(15):533-546.

Alcantara, A. B., & Riglietti, C. (2015). Assessment of materials management and profitability of an organization. *Journal of Policy and Development Studies.* 9(3):153-165.

Ali, B.-B. (2017). Research Design. Retrieved from https://www.researWhat_is_research_design

Aloini, D., Dulmin, R., Mininno, V., & Ponticelli, S. (2012). Supply Chain Management: A Review of Implementation Risks in the Construction Industry. *Business Process Management Journal*, 18(5):735-761.

Alreck, P. L., & Settle, R. B. (1985). *The Survey Research Handbook*. Richard D. Irwin, Inc., Homewood, Ill.

Amusan, L. M., Dosunmu, D., & Joshua, O. (2017). Cost andtime performance information of building projects in developing economy. *International Journal of Mechanical Engineering and Technology*, 8(10): 918-927

Atkinson, R. (2015). Project management: cost, time and quality, two best guesses and a phenomenon, it's time to accept other success criteria, 17(6):337-342.

Baily, P., Farmer, D., Crocker, B., Jessop, D., & Jones, D. (2013). Procurement, Principles and Management. *Pearson Education*.

Bima, A., Muhammad, T. A., & Baba, D. L. (2015). Appraisal of Construction Project Procurement Policies in Nigeria, *American Journal of Engineering Research*, 4(3):19-24.

Blaxter, L., Huges, C., & Tight, M. (2001). *How to research*. 2nd Edition, Open University Press, London, UK

Bossink, B., & Brouwers, H. (2015). Construction Waste: Quantification and Source Evaluation. *Journal of Construction Engineering and Management.* Retrieved from http://www.tue.nl/en/publication/ep/p/d/ep-uid/231803.

Brooks, M. J. (2014). Mitigating the safety risks of drugs with a focus on opioids: Are risk evaluation and mitigation strategies the answer?. Mayo Foundation for Medical Education and Research., 89(12):1673-1684

Caroline, A. (2015). Global Material Procurement Risk Management. *Journal of Business Logistics*, 29(1):133-56.

Chacon, N., Doherty, S., Hayashi, C., & Green, R. (2011). New models for addressing supply chain and transport risk. Risk Response Netwok.

Chepa, N, Nor, R. N. H., & Murad, M. A. A. (2015). A review on risk mitigation of IT governance. *Information Technology Journal*, 14(1):1-9

Christopher, M., & Lee, H. (2014). Mitigating Supply Chain Risk Through Improved Confidence. *International Journal of Physical Distribution and Logistics Management*, 34(5):388-396.

Construction Industry Institute (2012). Applying Probabilistic Risk Management in Design and Construction Projects. Austin, Texas: Construction Industry Institute.

Dada, J. O. (2010). Strategies for militating risk in construction projects. *In proceedings of the 40th Annual general meeting/conference of the Nigerian Institute of Building*, 7(11):28-35.

David, B., (2006). Study Claims Iraq's 'Excess' Death Toll Has Reached 655,000, *Washington Post*, Wednesday, October 11

Dim, N. U., & Ezeabasili, A. C. C. (2015). Strategic supply chain framework as an effective approach to procurement of public construction projects in Nigeria. International Journal of Management and Sustainability, 4(7):163-172

Ehsan, M., Jones, M., & James, P. (2010). A Review of the Progress Towards the Adoption of Supply Chain Management (SCM) Relationships in Construction. *European Journal of Purchasing and Supply Management*, 8(3):173-183.

Emily, T. I. (2013). Material Procurement Management in the UAE Construction Industry. *International Journal of Construction Management*, 8(1):53-71.

Eriksson, P. E., & Westerberg, M. (2011). Effects of cooperative procurement procedures on construction project performance: A conceptual framework. *International Journal of Project Management*, 3(29):197-208

Fadun, O. S., & Saka, S. T., (2018). Risk management in the construction industry: Analysis of critical success factors (CSFS) of construction projects in Nigeria. *International Journal of Development and Management Review*,13(1):14-20

Formoso, C. T., Soibelman, L. M., Cesare, C. D., & Isatto, E. L. (2012) Materials Waste in Building Industry: Main causes and prevention. *Journal of Construction Engineering and Management*, 128(4): 316-325.

Galway, L. (2014). Quantitative Risk Analysis for Project Management.

Ghasemi, F., Sari, M. H. M., Yousefi, V., Falsafi, R., & Tamošaitienė, J. (2018). *Project Portfolio* Risk Identification and Analysis, Considering Project Risk Interactions and Using Bayesian Networks. Sustainability, 10(5):1609.

Giannakis, M., & Louis, M. (2011). A Multi-agent based frame work for supply chain risk management, *Journal of Purchasing and Supply Management*, 9(17):23-31

Glass, J., Osmani, M., & Price, A. (2014). Architect's Perspective on Construction Waste Reduction by Design. Retrieved from www.lib.purdue.edu.

Gulghane, A. A., & Khandve, P. V. (2015). Management for Construction Materials and Control of Construction Waste in Construction Industry: A Review. *International Journal of Engineering Research and Applications*, 5(4): 59-64

Haddad, E. A. (2016). A Construction Materials Management System for Gaza Strip Building Contractors. A Thesis Submitted in partial fulfilment of the Requirements for the Degree of Master of Science in Construction Management. The Islamic University of Gaza. Deanery of Graduate Studies. Faculty of Engineering.

Hadikusumo, B. H. W., Petchpong, S., & Charoenngam, C. (2015). Construction material procurement using Internet-based agent system. *Automation in Construction*, 14(6):736- 749.

Harland, C., Brenchley, R., & Mulde, H. (2013). Risk in supply networks. [Internet:https://www.researchgate.net/publication/223757629 Risk in Supply Network 21 (8):18-25

Hatush, Z., & Skitmore, M. (2012). Contractor selection using multicriteria utility theory: An additive model. Building and Environment, 7(33):105-115.

Heckmann, J. K., Awolesi, J. A., & Akinseinde, O. A. (2015). An assessment of effect of procurement process on construction project delivery In: Ogunsemi, D.R, Awodele, O.A, & Oke, A.E (Eds). *Proceedings of the 2nd Nigerian Institute of Quantity Surveyors Research Conference* Federal University of Technology, 4(17):519-529).

Helbing, E. I., Kusterer, D. J., & Schmitz, P. W. (2016). Public–private partnerships versus traditional procurement: An experimental investigation. *Journal of Economic Behaviour & Organization*, *89*(14):145-166.

Ho, W., Zheng, T., Yildiz, H., & Talluri, S. (2015). Supply chain risk management: a literature review. *International Journal of Production Research*, *53*(16):5031–5069.

Ibegbulem, A. B., & Okorie, C. (2015). Assessment of materials management and profitability of an organization. *Journal of Policy and Development Studies*, 9(3):153-165

Ibironke, O. T. (2013). Analysis of Non-Excusable Delay Factors Influencing Contractors' Performance in Lagos State, Nigeria, *Journal of Construction in Developing Countries*, 18(1): 53–72

Isatolo, T. (2017). Basics of Statistics. Retrieved from https://docplayer.net/5451940-Basics-of-statistics.html ISO (2011). *ISO Guide 73*. Switzerland: ISO.

Jüttner, U., Peck, H., & Christopher, M. (2013). Supply Chain Risk Management: Outlining an Agenda for Future Research. *International Journal of Logistics: Research and Applications*, 6(4):197-210.

Kasim, N. (2011). ICT implementation for materials management in construction projects: Case Study. KICEM *Journal of Construction Engineering and Project Management*, 14(2):1-22

Kasim, N., Liwan, S. R., Shamsuddin, A., Zainal, R., & Che Kamaruddin, N. (2016). Improving on-site materials tracking for inventory management in construction projects. Proceeding *International Conference of Technology Management, Business and Entrepreneurship*: 447-452.

Khan, O., & Burnes, B. (2016). Risk and Supply Chain Management: Creating a Research Agenda. *The International Journal of Logistics Management*, 18(2):197-216.

Khyomesh, V. P., & Vyas, C. M. (2011). Construction material management on project sites. National conference on recent trends in engineering and technology.

Kolenko, S. (2016). Supply chain management. [Internet:https://www.crs.org/sites/default/files/ crsfiles institutional-strengthening supply-chain-management, 13(7):23-42

Kouvelis, P., Chambers, C., & Wang, H. (2012). Supply Chain Management Research and Production and Operations Management: Review, Trends, and Opportunities. *Production and Operations Management*, 15(3):449-469.

Kremljak, Z. (2014). Risk Management. Proceedings of the 21st International DAAAM Symposium, 21(1):253-254.

Kumar, L., Jindal, A., & Velaga, N. R. (2018). Financial risk assessment and modelling of PPP based Indian highway infrastructure projects. Transport Policy, 62(11): 2-11.

Kumar, V., & Viswanadham, N. (2017). A CBR-based Decision Support System Framework for Construction Supply Chain Risk Management. In Automation Science and Engineering, 2007. CASE 2007. *IEEE International Conference on IEEE.*: 980-985

Kuria, E. W., & Kimutai, G. (2018). Internal organization environment and project performance in construction firms within nairobi city county, kenya. *International Journal of Project Management*, 3(1):1-13.

Laerd Dissertation (2012). *Non-probability sampling* Lærd Dissertation. Retrieved from http://dissertation.laerd.com/non-probability-sampling.php

Leedy, P.D. & Ormrod, J.E. (2013). *Practical Research Planning and Design*, 10th Edition, England, Person Education Limited.

Loke, Y. S. (2013). *A study of causes and effects of conflict in construction industry*. BSc. Project Management. University Malaysia Pahang. Retrieved on September 12th, 2018, from http://umpir.ump.edu.my/id/eprint/8701/1/cd8461.pdf

Martindale, N. (2015). Rising risks in supply chain. [Internet:http://www.scrlc.com/articles/ Supply Chain Risk Management. A Compilation of Best Practices, 21(1):47-55.

Meehan, J., & Bryde, D. (2011). Sustainable procurement practice. *Business Strategy and the Environment*, *20*(2):94-106.

Megha, D., & Rajiv, B. (2013). A Methodology for Ranking of Causes of Delay for Residential Construction Projects in Indian Context. *International Journal of Emerging Technology and Advanced Engineering*, 3(3):396 – 404

Mehr, S. Y., & Omran, A. (2013). *Examining The Challenges Affect on the Effectiveness f Materials Management in the Malaysian Construction Industry*. International Journal of Academic Research. 5(2):11-18.

Merriam-Webster. (2018). Population Definition of Population by Merriam-Webster. Retrieved from https://www.merriam-webster.com/dictionary/population

Mohamed, A. (2017). Hassan Indian Ocean University, Business Administration, Department Member Somalia. https://iouniversity.academia.edu/MohamedAdamHassan

Muelbrook. (2012). Managing risk in virtual enterprise networks: implementing supply chain strategy, 22(6):101-109.)

Musa, N. D., Buniamin, S., Johari, N. H., Ahmad, N., Rauf, F. H. A., & Rashid, A. A. (2013). Key Indicators Towards the Implementation of Green Government Procurement in Malaysia.

Nnadi, E. O. E., Enebe, E. C., & Ugwu, O. O. (2018). Evaluating the Awareness Level of Risk Management amongst Construction Stakeholders in Nigeria. *International Journal of Construction Engineering and Management*, 7(1):47-52.

Nogueron, R., Laestadius, L., Lawson, J., MeadWestvaco, C. P. D. E. D., de WBCSD, T., McIntyre, B., & Mendiluce, M. (2011). www.sustainableforestprods.org

Obiegbu, M. E. (2010). A holistic overview of risk management in building project, *In proceedings of the 40th Annual general meeting/conference of the Nigerian Institute of Building*, 7th-11th July 2010, Asaba, Delta, Nigeria.

Ojo, G. K. (2010). An assessment of the construction site risk related factors, *In proceedings of the 40th Annual general meeting/conference of the Nigerian Institute of Building*, 7th- 11th July 2010, Asaba, Delta, Nigeria, 9-14.

Okonjo, E. A. (2014). Procurement risk management practices and supply chain performance of mobile phone service providers in Kenya.

Olamiwale, I. O. (2014). Evaluation of Risk Management Practices in the Construction Industry in Swaziland. Master of Quantity Surveying Thesis, Tshwane University of Technology, Pretoria, South Africa, 3(1):217-232.

Olaniyan, A., Bosede, A., & Olusola, O. (2015). Supply Chain Management Practices in Construction Procurement: Perceptions of Professional Quantity Surveyors in Ondo State, Nigeria‖. *PM World Journal,* 4(4):1-12.

Oyedele, A. (2015). Project management a panacea to improving the performance of construction projects in Ogun State Nigeria. *International Journal of Civil Engineering and Technology,* 8(9):1234-1242

Pallant, J. (2005). SPSS Survival Manual: A Step By Step Guide to Data Analysis Using SPSS for Windows (Version 12). Published by Allen & Unwin, 83 Alexander Street Crows Nest NSW 2065 Australia

Patel, K. V., & Vyas, C. (2011). Construction Materials Management on Project sites. In *National Conference on Recent Trends in Engineering & Technology*, *31*(6):2932-2941

Patience, F., Tunji, O., Adedeji, O., Afolabi, D., Rapheal, A., Ojelabi, L., & Beatrice, A. A. (2017). Impact of logistics factors on material procurement for construction projects. International Journal of Civil Engineering and Technology (IJCIET), 8(12):1142–1148

Patil, A. R., & Pataskar, S. V. (2013). Analysing Material Management Techniques on Construction Project, *International Journal of Engineering and Innovative Technology*, 3(4): 96-100

PMBOK. (2013). *A Guide to the Project Management Body of Knowledge: PMBOK(R) Guide*, Project Management Institute, USA.

Polat, G., & Arditi, D. (2015). "The JIT materials management system in developing countries." Constr. Manage. Econ., 23(7):697–712.

Polat, G., Arditi, D., & Mungen, U. (2017). Simulation-based decision support system for economical supply chain management of rebar. J. Constr. Eng. Manage., 133(1):29-39.

Poon, C. S., Yu, A. T. W., & Jaillon, L. (2014). Reducing building waste at construction sites in Hong Kong. *Construction Management and Economics,* 22 (6): 461–470.

Project Management Institute (2010). A Guide to the Project Management Body of Knowledge. Pennsylvania: Project Management Institute.

Rao, S., & Goldsby, T. J. (2015). Supply Chain Risks: A Review and Typology. *The International Journal of Logistics Management*, 20 (1):97-123.

Research Lifeline. (2012). Five Steps in Creating a Survey Sampling Plan. Retrieved from http://cdn2.hubspot.net/hub/58820/docs/rl_process_wp_five_step_sampling.pdf

Richard, H. A., Shahryar, S., Shariman, B. M., & Oluyinka, S. O. (2017). Constructions Project Management Risks' Framework, 18(158):22-29

Ritchie, B., & Brindley, C. (2012). Supply chain risk management and performance: A guiding framework for future development. *International Journal of Operations and Production Management*, 27(3):303-322.

Roshan, G., & Viswanadham, N. (2016). A conceptual and analytical framework for the management of risk in materials procurement. *IEEE Transactions on Automation & Systems Engineering,* 22(15):9-15.

SAGE Research Methods. (2010). *SAGE Research Method*s, primary data. https://doi.org/https://dx.doi.org/10.4135/9781412961288.n333

Saha, P. M. (2015). Asia-Pacific Supply Chain Management: Weak Links in Bangladesh, The Ethical Corporation Magazine, available at: www.ethicalcorp.com/content. asp? Content ID.4865.

Saidu, I., & Shakantu, W. (2016). The contributions of construction material waste to project cost overruns in Abuja, Nigeria. Acta Structilia, 23(1):99-113.

Seifbarghy, M. (2014). Measurement of Supply Risk and Determining Supply Strategy, 8(40):1-5

Seshadri, S., & Subrahmanyam, M. (2015). Introduction to the Special Issue on Risk Management in Operations. *Production and Operations Management*, 14(1):1-4.

Sheffi, Y. (2015). The Resilient Enterprise: Overcoming Vulnerability for Competitive Advantage, MIT Press, Cambridge, MA.

Sim, B., & Pabala, L. (2012). Reconceptualizing the Determinants of Risk Behavior. The Academy of Management Review 15-21. [Internet:http://www.jstor.org/stable/258646?seq=1;

Subramani1, T., & Prabhu, A. (2018). Material Procurement in Construction Industry Problems and Solutions. *International Journal of Engineering and Technology*, 7 (10): 31-35

Subsomboon, K., Christodoulou, S., & Griffis, F. H. (2013). "Procurement of services and materials using a FIAPP-based system—New York City case studies." Construction Research Congress-Wind of Change: Integration and Innovation, ASCE, Reston, VA.

Tang, C. S. (2016). Perspectives in Supply Chain Risk Management. *International Journal of Production Economics*, 103(2):451-488.

Teresa, P., Blackhurst, B., & Vellayappan, C. (2015). A Model for Inbound Supply Risk Analysis. [Internet:https://pdfs.semanticscholar.org/f860/e4966b88de018b32d4cdae87a7ba7efc2561.pdf; 14 June 2017]. (pp 1-16.)

Thomas, H. R., & Horman, M. J. (2015). "Role of inventory buffers in construction labor performance." J. Constr. Eng. Manage., 131(7):808-815.

Thomas, H. R., Riley, D. R., & Messner, J. I. (2015). "Fundamental principles of site materials management." J. Constr. Eng. Manage., 131(7):808–815.

Trochim, W. M. (2004). *The Research Methods Knowledge Base,* 2nd Edition. Internet URL: <http://trochim.human.cornell.edu/kb/index.htm>

Tserng, H. P., Samuel, Y. L., & Sherman, L. (2016). "Developing a resource supply chain planning system for construction projects." J. Constr. Eng. Manage, 132(4):393–407.

Tummala, R., & Schoenherr, T. (2011). Assessing and managing risks using the supply chain risk management process (SCRMP), *Supply Chain Management: An International Journal*, 16(6):474-483.

Tunji-Olayeni, P. F & Omuh, I. O. (2013). Strategies for improving indigenous contractors' participation in research and development in Nigeria. Retrieved from www.eprints.covenantuniversity.edu.ng

Tunji-Olayeni, P. F., Emeter, M. E & Afolabi, A. O. (2017). Multilayer perceptron network model for construction material procurement in fast developing cities. *International Journal of Civil Engineering and Technology*, 8(5):1468-1475

Ubani, C. E., Amade, B., Okorocha, A. K., Agwu, A., & Okogbuo, F. (2015). Project Risk Management Issues in the Nigerian Construction Industry, *International Journal of Engineering and Technical Research*, 3(1):217-232.

United Nations Procurement Practitioners Handbook. (2012). *Risk Management, risk types and effects.* Retrieved from https://www.ungm.org/Areas/Public/pph/ch04s01.html

Van Wyk, M. M., & Toale, M. (2015). *Research Design. Educational research: An African approach*, Oxford University Press, Cape Town.

Vrijhoef, R., & Koskela, L. (2010). The Four Roles of Supply Chain Management in Construction. *European Journal of Purchasing and Supply Management*, 6 (3):169-178.

Wagner, S. M., & Bode, C. (2017). An Empirical Examination of Supply Chain Performance Along Several Dimensions of Risk. *Journal of Business Logistics*, 29(1):307-325.

Watermeyer, R. B. (2012). A Framework for Developing Construction Procurement Strategy. *Proceedings of the Institute of Civil Engineers-Management, Procurement and law*, 165(4):223-237.

Xianhai M. (2012). Assessment framework for construction supply chain relationships: Development and evaluation. *International Journal of Project Management*, 28(9)695-707

Zhang, H., & Xing, F. (2010). Fuzzy-multi-objective particle swarm optimization for time-cost quality trade off in construction. Automation in Construction, 19(8):1067-1075.

Zsidisin, G., & Smith, M. (2015). Managing supply risk with early supplier involvement: A case study and research propositions, 221(18):3-5.

APPENDIX

RESEARCH QUESTIONNAIRE

COVERING LETTER ON QUESTIONNAIRE SURVEY

Dear Sir/Madam,

Research on: "**EFFECT OF MATERIALS PROCUREMENT RISKS FACTORS ON PERFORMANCE OF BUILDING PROJECTS IN ABUJA, NIGERIA**"

I am writing to request you to contribute to an MTech research, which aims to appraise the effect of material procurement risks factors on the performance of building projects in with a view to improving project performance. The research is being carried out at the Department of Quantity Surveying, Federal University of Technology, Minna – Nigeria under the supervision of Dr. I. Saidu.

As part of this research, a survey is conducted to achieve the following objectives:

1. Examine the inherent materials procurement risk factors in building projects;
2. Examine the effect of the materials procurement risks factors on time, cost and quality performance of building projects;
3. Determine strategies for dealing with materials procurement risks in building construction projects for improved project performance.

It would be greatly appreciated if you would fill the questionnaire as soon as possible. I want you to also note that your responses will be treated confidentially.

Thanks.

Yours faithfully,

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QUESTIONNAIRE SURVEY

EFFECT OF MATERIALS PROCUREMENT RISKS FACTORS ON PERFORMANCE OF BUILDING PROJECTS IN ABUJA, NIGERIA

SECTION A: Particulars and General Information

Please enter your name, position and other personal details.
All responses will be confidential and will not be connected in any way to yourself or your organisation.

Name (Optional): _____

Position: _____

Organisation: _____

Gender: Male [ ] Female [ ]

Years of Experience: _____

Position on Project: Project Manager ☐ Site Manager ☐

Contractor ☐ Procurement Manager ☐

Years of experience in the construction industry: Less than 5 ☐ 5-10 ☐
11-20 ☐ 21-30 ☐ Above 30 ☐

Academic Qualification: ND ☐ HND ☐ BSc/ BTech ☐ MSc/MTech. ☐

Others, please specify_____

SECTION B: The inherent materials procurement risks factors in building projects

Q1: The following are the inherent materials procurement risk factors in building project. Please rank the level at which these risks are likely to occur in building projects using the scales provided below: 5-Most often, 4-Often, 3-Less often, 2- Least often, 1-Rearly

S/No.	Materials Procurement Risk Factors	Rating				
		5	4	3	2	1
1.	Policy changes					
2.	Fluctuations in prices					
3.	Natural occurrences for instance fire					
4.	Shortage of raw materials					
5.	Unexpected changes in demand					
6.	New and existing competitors					
7.	Bad debt					
8.	Changes in interest rates					
9.	Uncertain research and development results					
10.	Labour uncertainties (for instance strikes)					
11.	Frequent changes in supply chain inputs					
12.	Fragmented decision-making					
13.	Quality/excessive snagging					
14.	Inappropriate design for scheme					
15.	Site impact on local community					
16.	Incompetency of site management					
17.	Volatility of supply chain workflow					
18.	Ineffectiveness of arrangements					
19.	New technology or technique					
20.	Inconsistency of suppliers					
21.	Inflexible design					
22.	Experience of subcontractors					
23.	Incompetency of project team					
24.	Security					
25.	Responsiveness of suppliers					
26.	Changes in quantity/scope of work					
27.	Inflation					
28.	Quality control and assurance					
29.	Difficulties/delays in availability of materials, equipment and labour					
30.	Bureaucratic problems					

31.	Inadequate specifications					
32.	Permit and approval					
33.	Owner and contractor experience					
34.	Site access/right of ways					
35.	Design changes					
36.	Third party delay and default					
37.	Financial failure-any party					
38.	Differing site conditions (unforeseen site conditions)					
39.	Delay in design/redesign if over budget					
40.	Exceptionally inclement weather					

SECTION C: The effect of the materials procurement risks factors affecting time, cost and quality performance of building projects

Q2: The following are the effect of the materials procurement risks factors. Indicate their effect on the performance of building projects. Please rank these effects in order of importance based on your experience on a five-point scale in the spaces provided in the table below.
(1=Not severe; 2=Slightly Severe; 3=Severe; 4=Very Severe; 5=Extremely Severe).

i. Materials procurement risks factors on time performance of building projects

S/No.	Materials procurement risks factors on time performance	Rating				
		5	4	3	2	1
1.	Permit and approval					
2.	Changes in quantity/scope of work					
3.	Owner and contractor experience					
4.	Site access/right of ways					
5.	Design changes					
6.	Difficulties/delays in availability of materials, equipment and labour					
7.	Third party delay and default					
8.	Financial failure-any party					
9.	Differing site conditions (unforeseen site conditions)					
10.	Bureaucratic problems					
11.	Inadequate specification					
12.	Delay in design/redesign if over budget					
13.	Exceptionally inclement weather					
14.	Force majeure					
15.	Shortage of raw materials					
16.	Unexpected changes in demand					
17.	New and existing competitors					
18.	Bad debt					
19.	Inappropriate design for scheme					
20.	Inflexible design					
21.	Responsiveness of suppliers					

22.	Incompetency of project team					
23.	Experience of subcontractors					
24.	Inconsistency of suppliers					
25.	Incompetency of site management					
26.	Policy changes					
27.	Volatility of supply chain workflow					
28.	Ineffectiveness of arrangements					

ii. Materials procurement risks factors on cost performance of building projects

S/No.	Materials procurement risks factors on cost performance	Rating				
		5	4	3	2	1
1.	Changes in quantity/scope of work					
2.	Inflation					
3.	Quality control and assurance					
4.	Difficulties/delays in availability of materials, Equipment and labour					
5.	Bureaucratic problems					
6.	Inadequate specifications					
7.	Force majeure					
8.	Owner and contractor experience					
9.	Fluctuations in prices					
10.	Policy changes					
11.	Unexpected changes in demand					
12.	Labour uncertainties (for instance strikes)					
13.	Frequent changes in supply chain inputs					
14.	Bad debt					
15.	New technology or technique					
16.	Security					
17.	Changes in quantity/scope of work					
18.	Changes in interest rates					
19.	Uncertain research and development results					
20.	Differing site conditions (unforeseen site conditions)					
21.	Financial failure-any party					
22.	Site impact on local community					
23.	Shortage of raw materials					
24.	Design changes					
25.	New and existing competitors					

iii. Materials procurement risks factors on quality performance of building projects

S/No.	Materials procurement risks factors on quality performance	Rating				
		5	4	3	2	1
1.	Quality control and assurance					
2.	Owner and contract experience					

3.	Inadequate specifications					
4.	Differing site condition (unforeseen ground conditions)					
5.	Force majeure					
6.	Shortage of raw materials					
7.	Unexpected changes in demand					
8.	Bad debt					
9.	Changes in interest rates					
10.	Labour uncertainties (for instance strikes)					
11.	Frequent changes in supply chain inputs					
12.	Quality/excessive snagging					
13.	Incompetency of site management					
14.	Inconsistency of suppliers					
15.	Inflexible design					
16.	Experience of subcontractors					
17.	Incompetency of project team					
18.	Responsiveness of suppliers					
19.	Changes in quantity/scope of work					

SECTION D: Strategies for dealing with materials procurement risks in building construction projects.

The following are the strategies for mitigating materials procurement risks in building construction projects. Please kindly respond by placing a tick in the appropriate box to demonstrate your level of agreement with the risk response strategies, using the scales below:

1-Very low, 2-low, 3-Moderate, 4-High, and 5-Very high

S/No	Strategies for dealing with materials procurement risks	Rating				
		5	4	3	2	1
A	**Risk avoidance (Doing something else or take a different route)**					
1.	Eliminating the cause of the risk					
2.	Reducing the scope of the contract					
3.	Adding resources or time to the contract					
4.	Avoiding contractor with unproven track record					
5.	Using a proven approach instead of a new one.					
B	**Risk Transfer (Sharing)**					
6.	Allocating risks to other entities e.g. outsourcing					
7.	Buying insurance to cover any financial loss should the risk become reality					
8.	It comes with additional costs, such as the cost of insurance or additional amount tacked on to the pricing by the contractor in order to deal with the event when it occurs.					
9.	Transferring particular risks to the contractor through negotiation might be better					

C	**Risk Reduction (Optimize-mitigate)- Doing something to reduces the impact or probability of a risk**					
10.	Communication-communicating risk may serve to reduce it					
11.	Contingency plans- Planning for critical situations can reduce the impact of such events should they occur					
12.	Error tolerant design-User interfaces that prevent human error from having serious consequences					
13.	Due diligence- Investigation process before committing to a contract.					
14.	Policies design to reduce risk					
15.	Controls built in to process such as approvals designed to reduce procurement risks					
16.	Process improvements such as automating steps to reduce errors					
17.	Establishing standards to guide procurement practices and decision making					
18.	Verifying information with Authoritative information sources					
19.	Validation of information before it is accepted by system					
20.	Compliance training for procurement employee design to reduce compliance and reputational risks					
21.	System testing- is a core risk reduction technique					
22.	Review of decisions and implementations by experts can reduce risks					
D	**Risk Acceptance (Do nothing)**					
23.	Accept the consequences of the risk event (when it occurs)					
24.	Developing a contingency plan for execution should the risk event occur					
25.	Deciding to deal with the risks and their consequences when or if they occur but not planning for them in advance					