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Assessment of the Triggers of Inefficient Materials Management Practices by Construction SMEs in Nigeria

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Abstract

Inefficient material management throughout the construction projects value chain has resulted to poor performance especially in terms of time, cost, quality, and productivity. Even well-organised large construction organisations still fall prey to this project performance killer; as adequate attention is not given to material management as a necessary key project management function. Thus, this study assessed the factors that trigger inefficient material management practices by construction SMEs in Port Harcourt, Nigeria. The study utilised a quantitative survey method and convenience sampling technique in the distribution of the structured questionnaire used to gather data from project managers, procurement officers and construction professionals working with the construction SMEs. With a 93.33% response rate, the gathered data were analysed using percentage, frequencies and factor analysis with principal component analysis. It was found that the major triggers of inefficient materials management among construction SMEs are; traditional approach and maintenance issues, manufacturer error and poor planning, inventory management issues, poor handling of procurement, materials estimating problems, storage problems and insecurity, and communication issues. It was concluded that the predominance of these triggers in the management of materials among construction SMEs would result in a continued poor performance of construction projects, especially with regards to project time, cost, quality and productivity. The study recommends a move away from the traditional methods of managing materials and the adoption of a technological-based material management system.

Keywords: Construction industry, construction SMEs, construction project performance, inefficient material management, Nigeria

■1.0 INTRODUCTION

The construction industry is the economic prime mover and the bedrock of survival of nations. The rate of economic growth and development of any nation is measured by the available infrastructure; these include roads, buildings, bridges (F. H. Ahmed, 2017). The industry is adjudged an influential sector that provides job and stimulates growth in the economy (Onyeagam et al., 2019); it is also regarded as an agent for national development (Ibrahim et al., 2010; Jusoh & Kasim, 2017; Nwachukwu & Emoh, 2010). Similarly, construction SMEs are the mainstay of any nation and contribute to economic development globally. Construction SMEs play a vital role in developing economies in the area of job creation, employment, poverty reduction, product innovation, and research (Ahiawodzi & Adade**,** 2012; Usman & Alaezi, 2016).

In Nigeria, the growth and development of industries depend on the growth of the small- and medium-scale enterprises (SMEs) (Umana, 2018). This is based on the important role being played by these enterprises, especially in the area of unemployment reduction, productivity, income distribution through investment increase and profits (Umana, 2018); these enterprises are, therefore, called 'development drivers'. Usman and Alaezi (2016) submit that construction SMEs activities contribute to enhancing the gross domestic product (GDP). The volume of a country's Gross Domestic Product (GDP) is a reflection of its economic growth and development. Small- and medium- scale enterprises (SMEs) in Nigeria have a major feature which is the inefficiency in the overall management and poor record keeping. This is attributed to the lack of essential and required manpower used in production, procurement, maintenance, marketing and finances (Umana, 2018).

However, despite the enormous benefits derived from the activities of this industry and construction SMEs, construction projects are known to be plagued by poor performance (Jusoh & Kasim, 2017; Smith et al., 2014). This reflects in the persistent delays, wastage, cost overrun, quality issues, low productivity often experienced. One of the major causes of the poor performance experienced in construction projects is ineffective management of materials in most construction sites (Jusoh & Kasim, 2017). Proper management of construction materials is critical to determining the overall performance of construction projects with regards to time, cost, quality, and productivity (Kasim et al., 2005). Problems of material management have resulted from the numerous challenges facing construction SMEs. Over-reliance on individual project managers for procurement and other logistics have caused several management issues (Usman & Alaezi, 2016). These have led to poor performance and delivery of construction projects within. Teni (2013) reported that the perception of construction stakeholders regarding material management is poor. This implies that materials management is not seen as necessary for construction projects. Earlier, Donyavi and Flanagan (2009) submitted that construction SMEs pays little attention to planning as a result of the pressure of achieving milestone dates; thus, insufficient time is allocated in ensuring proper material management.

Most Nigerian SMEs dies off or goes into extinction within a period ranging from 5-10 years of their establishment; thus, do not reach maturity in their life cycle (Aremu & Adeyemi, 2011; Olowe et al., 2013). This is, despite the efforts of successive government to strengthen Nigerian SMEs. Non-construction SMEs have failed to perform and contribute significantly to national economic growth and development (Kareem, 2018), and this is no different from Construction SMEs. This failure could be attributed to management issues as regards materials and other project and organisational resources.

Mismanagement of material and other resource has been one of the major challenges facing SMEs globally (Kareem, 2018). As a result of inefficient management of resources, about 5% of global GDP is lost (International Bank for Reconstruction and Development, 2014). This according to Kagashe and Massawe (2012), is attributed to improper materials and inventory control and management especially in countries with less developed economies like Nigeria; and the consequence is the sluggish rate of growth in the country. Delays in material delivery, lack of technology, lack of professional personnel, financial issues and storage issues were found to affect the performance of SMEs in Nigeria (Kareem, 2018). Ineffective material management can impact on the performance of an organisation and their projects; with the extended consequence being the loss of competitiveness and survival in the larger construction market. According to Kruger (2005) and Wallin et al. (2006), effective material management has remained a crucial survival and competitive strategy in the marketplace; and Rajeev (2008) sees it as a way of enhancing firm's effectiveness and efficiency. Effective materials management can lead to better performance of construction projects and organisational growth, success and survival. According to Igbojiaku (2007), ineffective materials can lead to the demise of a company. Effective and efficient material management, is thus, very crucial for construction SMEs existence.

There is a dearth of literature on material management by construction SMEs, especially in the study area. Related and existing studies on SMEs focused majorly on manufacturing (Akindipe, 2014; Kareem, 2018; Muchaendepi et al., 2019), processing industry (Zhang, 2014), pro-activeness and survival of SMEs (Amah, 2017), issues, challenges and prospects of SMEs (Agwu, 2014), construction innovations (Tsado et al., 2020), and agro-allied SMEs (Roko et al., 2016), to name a few. While there are extant studies that focused on material management in construction, there is little or nothing done as regards inefficient management of materials in Port Harcourt, Nigeria with a focus on construction SMEs.

It is based on this knowledge and with the understanding of unavailability of studies on materials management by construction SMEs, especially in the geographical area of this study, that this study was embarked upon. This study aims to assess the factors that trigger inefficient material management practices by construction SMEs, with a view to advancing measures to avoid their occurrence. Materials are cost-sensitive items and form a major part of every construction project, thus, assessing the factors that trigger inefficient material management practice by construction SMEs will serve as an indication and direction of the main triggers, so that appropriate measures would be put in place to ensure that projects are timely delivered, and within agreed quality specification and budget. The outcome of this study will increase available knowledge on material management in construction. Stakeholders in the construction SMEs will be updated with information regarding the causes of the inefficiencies in the management of the materials so that appropriate decision in the handling of procurement and materials purchase decisions could be made.

2.0 LITERATURE REVIEW

2.1 Materials Management and SMEs

Materials management covers the activities and processes that take place both on-site and in the office involving the planning, purchasing, executing, coordinating, and controlling and storing of construction materials (Dakhli & Lafhaj, 2018; Patel & Vyas, 2011). The management of materials is a critical function of project management aimed at ensuring and guaranteeing construction projects productivity improvement. It also focused on ensuring that construction materials are obtained at an economical cost, at the appropriate time and quantity; thus, making them readily accessible at the point of use when needed (Caldas et al., 2015; Dakhli & Lafhaj, 2018; Jusoh & Kasim, 2017; Patel & Vyas, 2011). Caldas et al. (2015) and Jusoh and Kasim (2017) further submitted that material management is concerned with the planning and controlling process that ensures that the quantity and quality of materials equipment needed are properly identified promptly so that they are obtained in the best cost possible.

Materials form a greater proportion of both building and civil engineering construction projects, thus, consuming a higher value of every construction projects more than equipment and labour. Patel and Vyas (2011) and Phu and Cho (2014) posits that 30% to 70% of the project budget is consumed by materials with about 30% to 40% on labour. Similarly, Safa et al. (2014) and Jusoh and Kasim (2017) submitted that about 50% - 60% of the total cost of construction projects are materials. It was further claimed that the cost of materials is not stable, and it might be up to or more than 20% - 70% of the total cost of the project (Gulghane & Khandve, 2015; Patil & Pataskar, 2013). Kasim et al. (2019) posit that up to 70% of the entire project cost covers construction materials and equipment, even for a less complex and single project. This makes the management of materials a critical part of every construction phases. Owing to the critical roles of materials and the proportion of the project cost it occupies, there is the need for both large companies and construction SMEs to understand the effects of ineffective materials management on project execution and delivery (Caldas et al., 2015).

Successful delivery of construction project is anchored on an efficient materials management, thus, efficient materials management leads to an appreciable saving in project costs (Arijeloye & Akinradewo, 2016; Patel & Vyas, 2011; Tedla & Patel, 2018). Material management activities span throughout the entire duration of a construction project. As a result of this, Arijeloye and Akinradewo (2016) warned that if all project materials are not properly managed from design stage to the construction stage, poor and ineffective handling of construction materials might be the case; and this could lead to the failure of performance of the construction projects in terms of cost, time, quality and productivity. It was further emphasized that material management activities should start before the actual production of work items on site. Thus, proactive material management will minimize waste during construction and the profit of the contractor is maintained (Kasim et al., 2005). In the same line of thought, Patel and Vyas (2011) accentuated that since materials represent a key expenditure head in construction, minimizing the cost of procurement offers opportunities for decreasing the global project costs. It is worthy of note that poor materials management which has already impacted on the construction cost, can cause interest charges incurred on excess inventory to be high. Kasim (2008) submitted that poor construction materials handling has a negative effect on achieving the specified construction project performance. The performance affected is in the areas of quality, cost (budget), time (schedule), productivity, claims and disputes. It was advised that for construction firms to avoid profit losses, materials wastages should be greatly reduced through an efficient material management system.

Small and medium enterprises (SMEs) definition is about firms' turnover and the number of employees engaged (Donyavi & Flanagan, 2009). SMEs only represent businesses and they are not public limited company; the terms of employment, asset value and dollar sales are what define SMEs (Lucky & Olusegun, 2012). The 2005 Central Bank of Nigeria's guideline on Small and medium enterprises investment scheme (SMEIS), defined SME as any enterprise having a maximum asset base of 200 million Naira (excluding land and working capital) with no lower or upper limit of staff (Etuk et al., 2014). According to Gulani and Usman (2012), small scale businesses are those whose total asset in capital, equipment, plant and working capital is less than ₦250,000 and employing fewer than 50 full-time workers. SMEs is defined as enterprises with an employment-population of fewer than 250 persons and an annual turnover of not greater than €50 million, and an annual balance sheet total of not exceeding €43 million (European Commission, 2015). A small firm is one which employs not more than 50 persons and with an annual turnover of less than €10million. SMEDAN/NBS MSME Survey (2013) presented a national policy on MSMEs to cater for the issue of determining what the meaning of the micro, small, and medium enterprises in Nigeria entails. Similarly, a national survey report carried out in 2017 on micro, small, and medium enterprises (MSME) and published in 2019 by NBS, presented a clearer picture of the definition of SMEs. The definition of SMEs as contained in National Bureau of Statistics (2019) reports and SMEDAN/NBS MSME Survey (2013) is displayed in Table 1; becoming the working definition that has guided this study.

Table 1 Classification of CSMEs/MSMEs in Nigeria

S/N	Size category	Employment	Assets (₦ Million) (excluding land and buildings)
1	Micro enterprises	less than 10	Less than 5
2	Small enterprises	10 to 49	5 to less than 50
3	Medium enterprises	50 to 199	50 to less than 500

Sources: SMEDAN/NBS MSME Survey (2013); National Bureau of Statistics (2019)

SMEs are the major drivers of economic growth, innovation, employment and social integration in both developed and developing nations of the world. SMEs strengthen the economic base of a nation; construction SMEs form bulk of the contracting and subcontracting organisations and they can be engaged in both small and large projects (Donyavi & Flanagan, 2009). According to the European Commission (2015) and Lu (2018), about 99% of businesses in the EU are SMEs, and 99.9% of construction contracting businesses in the UK are SMEs. Construction SMEs accounts for about 5% of Nigerian GDP, while in South Africa it is 19%, Mexico 17.7% and Ghana 8% (Usman et al., 2014). In spite, of their coverage and numerical strength, construction SMEs still find it impracticable to break into the market especially for larger projects in the public sector. It was reported that about 40% of construction SMEs fails to win 9 out of 10 public sector contract and more than half are experiencing business failures over the last 5 years. This situation is attributed to the cost and difficulty of pre-qualification and tendering (European Commission, 2015).

According to Zakariya et al. (2019), SMEs are currently facing problems of materials procurement, inventory and supply; and this is attributed to the economic downturn. A considerable amount of money is invested in materials and this is meant for their survival (Asaolu, 2012; Zakariya et al., 2019). In order to deliver projects within time and cost, SMEs often are engaged in the purchase of low-quality materials to cut cost, and this usually is against the contract specifications. Even when these materials are procured, adequate attention is not given to proper materials management (Zakariya et al., 2019). Thus, for the effective operation of SMEs, the application of proper materials management technique is required. Therefore, according to Akindipe (2014) materials management is significant for the proper functioning of SMEs.

2.2 Materials Management Process

Every construction project is unique, but all projects essentially involve the same basic resources. The construction manager is concerned with the management of these resources to maximize their use, to maximize their cost and to complete the project within time and budget, and safely. The principal resources involved in a construction project are materials, labour, plant and finance. The correct management of these resources ensures that the contractor completes the project according to the contract (Hore et al., 1997). Thus, Pal and Ahire (2016) highlighted the objectives of managing materials to include; ensuring time savings, project cost reduction, improved departmental efficiency, quality assurance, supply and distribution of materials, stock and waste control, achieve economy of projects, good supplier and customer relationship, procuring and receiving, efficient materials planning, storing and inventory control, buying or purchasing.

Hore et al. (1997) proposed seven (7) steps for a good material management process for ensuring that all materials are delivered to site to enable them to be incorporated in the works at the right time, in the correct quantity, at the best cost of the correct quality. These steps include:

i. Scheduling
ii. Requisitioning
iii. Ordering
iv. Receiving and handling
v. Storage and Security
vi. Issuing
vii. Incorporating

According to Pal and Ahire (2016) and Z. Ahmed (2017), material management involves series of properly integrated, harmonized and coordinated processes that are required to towards ensuring that materials needed are available at the point of use. From the materials management flow chart in Figure 1; the process starts from need generated from the site (this could be from any trade on site); this information conveyed to store department (using store requisition voucher, SRV) and the material is ordered and indent is generated. The SRV contains the name and quantity of materials, name of requisitioner, date, and signature. SRV is used for materials approval, store issuing and security checks on site. Normally, from the material consumption tracking sheet (or stock records) availability and balance are identified. Habitually, vendor selection is made for the least value and best items. Materials are delivered to site and received at store departments, and inspection is carried out (this involved the store, security and quality assurance and quality control departments). Depending on the nature of the contract inspection specification; another line of inspection with the client agent might be done before actual issuing of materials to site (requisitioning unit) for incorporation into the works.

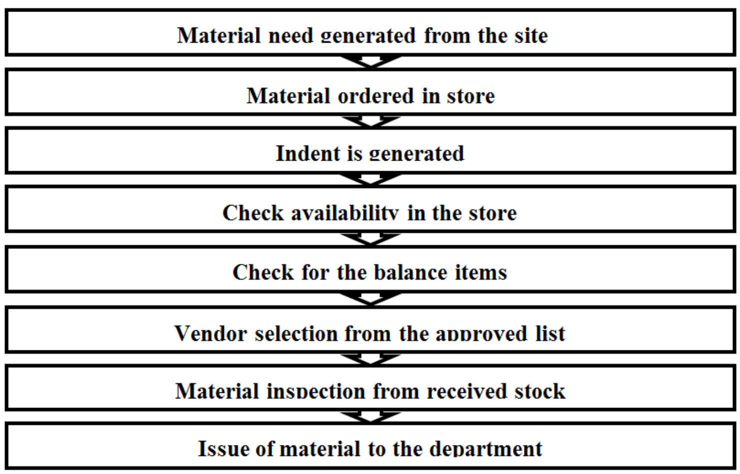

Figure 1 Flow chart for an ideal material management process
(Sources: Patel and Vyas, 2011; Patil and Pataskar, 2013;
Pal and Ahire, 2016; Z. Ahmed, 2017; Tedla and Patel, 2018)

2.2.1 Classification of Construction Materials

According to Teni (2013), the key vital materials requiring storage facility on-site which the contractor must make provision for include; cement, timers, pipes, electrical and sanitary materials. While, those that do not need storage facility are sand, stone, blocks, curbstone and terrazzo tile. These materials are not affected by elements of weather and therefore, do not require to be put in storage rooms. These materials regardless of the need for storage are to be effectively managed for project success and organisational success.

Chandler (1978) gave some classification of major materials input to construction work. Building construction materials were categories into five groups depending on the method of fabrication and on-site handling approach. These five groups are explained below:

i. Bulk materials - those materials that are put in containers and conveyed and delivered in mass
ii. Bagged materials - those materials owing to the ease of handling and control during use are supplied in bags from construction materials manufacturers.
iii. Palleted materials - materials supplied in bags are sometimes placed in pallets prior to delivery on site.
iv. Packaged materials - those materials that are packaged together for the purpose of preventing transportation damages and decay in the store.
v. Loose materials - these by their nature or fabrication are to be handled individually.

Table 2 contains some of the materials that need to be managed by the contractors and their classification.

Table 2 Building materials input classification

S/Nr	Materials	Bulk	Bagged	Pallated	Packaged	Loose
1	Reinforcement steel				✓	✓
2	Blocks			✓	✓	✓
3	Sand	✓				
4	gravel/chippings	✓				
5	Top soil	✓				
6	Paving slabs					✓
7	Structural timber					✓
8	Cement	✓	✓	✓		
9	Concrete	✓				
10	Pipes				✓	✓
11	Tiles			✓	✓	
12	Paintings			✓	✓	
13	Door & Windows			✓		
14	Electrical fittings				✓	
15	Plumbing materials				✓	
16	mechanical fittings				✓	

Sources: Modified from Chandler (1978) and Teni (2013)

2.3 Materials Management Practices by SMEs

According to Gulghane and Khandve (2015), there are five (5) processes into which materials management practices on building project are categorized, and these are; planning, purchasing, transportation, handling and waste control. Other practices that need to be taken seriously in the course of managing materials according to Ocheoha and Moselhi (2013) are; just-in-time, economic order quantity, and warehousing. However, owing to the less bureaucratic management process and sole-ownership nature of construction SMEs, some of these practices are not judiciously followed. This could the reason why Donyavi and Flanagan (2009) posit that construction SMEs pays little attention to doing detailed activities planning as a result of the pressure of achieving milestone dates; thus, insufficient time is allocated to ensuring proper material management.

Furthermore, according to the report of Kulkarni et al. (2017), small and medium construction firms do not use material management software, as such, they lack behind in materials. Construction SMEs does not have a dedicated department responsible for material management. It was further revealed that projects handled by the SMEs suffer from delays, cost overrun; low of productivity and increased materials waste; as a result of their lack of effective materials management. Poor and inadequate start-up process, financial challenges, lack of infrastructural development, the problem of low patronage, and management problem; have been reported as the major problems facing construction SME (Umana, 2018).

The material management practice of small construction firms immediately after contract award are; planning of the entire construction activities, generation of quantities of materials and other resources need for the execution of the project and placing of orders based on estimated quantities either by a phone call or personal visit to the construction material market. Order placed, records kept and when materials are delivered on-site, they are inspected to ensure that the right quantity and quality are supplied. Kulkarni et al. (2017) summarised the materials management practices of the Small firms into 6 processes as indicated in Figure 2 below. These processes are purely traditional with a lot of paperwork.

For the medium-sized construction organisation, the practice of material management is a bit advanced from what is obtained in the small size firms. The 11 common processes for managing materials in the medium size firm as detailed by Kulkarni et al. (2017) is indicated in Figure 3.

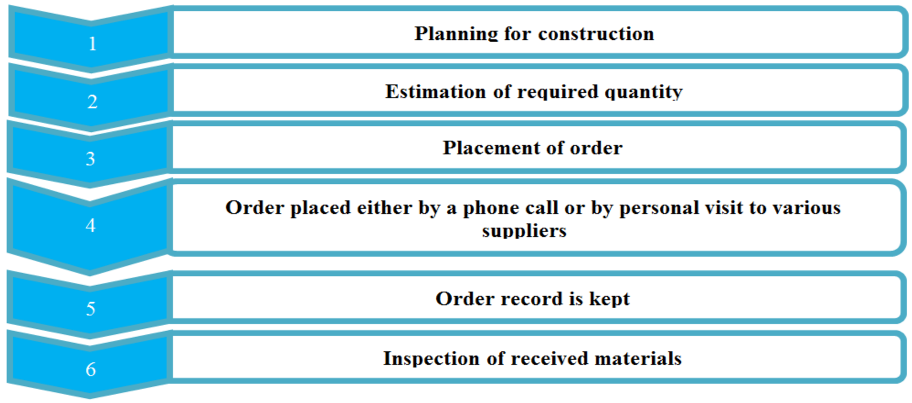

Figure 2 Common procedure for material management in small firms
(Source: Adapted from Kulkarni et al., 2017)

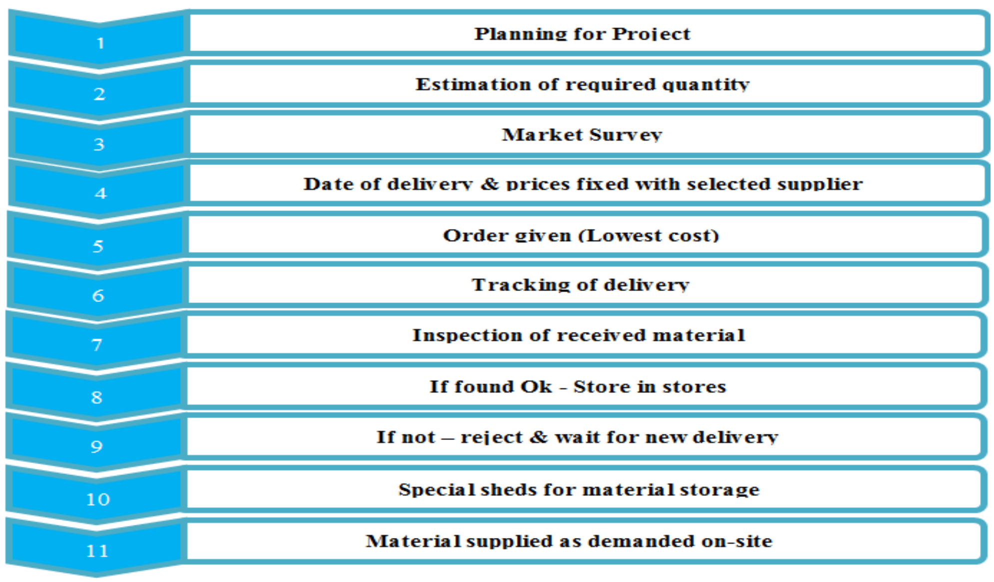

Figure 3 Common procedure for material management in medium firms
(Source: Adapted from Kulkarni et al., 2017)

2.4 Triggers of Inefficient Materials Management Practices by SMEs

An event or condition that influences the occurrence of risk, unpleasant situation or hampers performance is known as a trigger (Eze et al., 2018a). Not getting adequate productivity, failure to meet and make the best use of resources, energy, supplies, time, among others is known as inefficient. Material management involves the making of concerted efforts in ensuring a seamless flow of materials in and out of organisation or project; to guarantee the availability of the right quantity and quality of materials, at the right time and place, at an economical cost (Rahman, 2014). Based on this definitions, triggers of inefficient material management are variables or events that can impede the seamless flow of materials, especially in a construction project; to the extents that there is a loss of productivity, increase waste, delays, cost overruns, poor quality, and claims and disputes. There are a lot of triggers of inefficient management of construction materials in both the developed and developing construction industries of the world.

According to Phu and Cho (2014), some of the factors that may affect the management of construction materials are; transportation problems, poor materials handling on-site, abuse of materials specification, poor work plan, over-reliance on paperwork and incorrect material delivery. Sawalhi and Kass (2012) reported that increase in material waste experienced on-site and the factors that can hamper materials management efforts are; defective materials (manufacturing faults), damaged materials on-site, poor materials cutting, double handling of materials transport, incomplete instruction on how materials are to be handled, poor handling of materials on-site, storage facility located too far from the site, poor contractors' technical staff qualification.

Factors responsible for ineffective materials management according to (Kasim & Ern, 2010; Kazaz et al., 2008; Navon & Berkovich, 2006; Rivas et al., 2011) are fluctuation in the prices of materials, faulty materials ordering, Wrong materials delivery, uncoordinated and disorder in the flow of materials, poor materials storage system, wrong materials sorting, inadequate equipment, regular breakdown of equipment, poor inventory and nonexistence of materials status report, poor materials coordination, voluminous paperwork, delay in materials delivery, ineffective communication among members, delay in procuring construction materials, poor layout of materials handling, multiple handling of materials and poor materials planning. It was further stated that material tracking has remained a problem in most construction sites; thus, there is a lack of relevant information that is up-to-date (Navon & Berkovich, 2005; Sawalhi & Kass, 2012).

The major problems of materials management included; delivery of materials at the wrong time, wrong material quantity, the disparity between the specification of purchase-order, the omission of required (ordered) materials, lack of information on the status of orders, lack of complete information on stock, lack of up-to-date information on materials delivery, a surplus of materials delivery, lack of materials storage space, loss of man-hour tracking and searching for materials (Navon & Berkovich, 2005).

Dey (2001) states that the common issues of material management include; pre-mature delivery of materials on-site, late delivery of materials, wrong take-off of materials from contract drawings, design changes at the construction stage, damaged and or loss of items, management of surplus materials. Furthermore, it was submitted that material shortage is a critical contributor to delays in the management of materials, and by extension construction work (Abdul-Rahman et al., 2006; Aibinu & Odeyinka, 2006). Also, when there is late delivery of materials to the site, material management becomes an issue; this was confirmed by Kasim (2008). Kasim (2008) investigated 6 case studies in an attempt to find the problems in material management. The study revealed 17 triggers of ineffective materials management on the construction sites. These include late material delivery, limited storage spaces, logistics problems, wrong (incorrect) materials delivery, inadequate loading area, site access problem, regulation consideration, time constraints, incomplete delivery, constraints storage compound, material damages, lack of materials, improper handling, tower crane distribution problem, supply chain challenge, project size challenge and project location challenge. It was stated that the late delivery of ordered materials is problematic in materials management. It was suggested that the factors that contribute to poor materials management in construction projects are transport difficulties, lack of a proper work plan, waste, inappropriate materials delivery, improper handling on-site, excessive paperwork, and misuse of the specification (Zakeri et al., 1996); these variables hampers materials management efforts. According to Teni (2013), the factors that can cause loss of productivity and overall delays which could lead to an indirect increase in the overall cost of managing materials and projects are poor identification of materials, poor planning and control of materials, lack of materials when needed, inadequate storage and double handling of materials. Kulkarni et al. (2017) posit that materials management are affected by variables such as; delay due to rejection of materials from quality control team, transportation problems, seasonal problems, labour strike, communication problems, improper handling and lack of material management.

In an attempt to understand the causes of ineffective materials management, Patel and Vyas (2011) divided into four (4) the material management process; these are material identification, vendor selection, procurement and construction phase. 35 causes where identified all together, and these are undefined scope, lack of communication, incomplete drawings, lack of conformance to requirements, nonstandard specification, incomplete/ ineffective meeting, difference between plans and specification, not determining what and when materials needed, uncontrollable bid list, incomplete proposal, time spent in investigating non-qualified suppliers, availability of material, availability of required quality, matching price to competitors price, late deliveries, late or incorrect submittals, poor communication, lack of conformance to requirements, unrealistic delivery date, vague stated requirements, re-handling of material, storage of materials, theft, damage of material, incorrect type of material delivery, incorrect sizes delivered, incorrect quantity delivered, keeping track of material, re-handling of material, storage of material, loss of material, damage of material, no supplier quality assurance, poor communication, and receiving handling and storage of unused materials. According to the study of Patel and Vyas (2011), the most prominent causes of ineffective material management are improper storage facility, less of the estimated materials are bought, absence of proper coordination, no automation in managing the materials. The study suggested that a system for managing materials centrally should be established, and the establishment of a coordinating team between the site and the organization.

According to Gulghane and Khandve (2015), ineffective materials management are triggered by problematic issues like improper planning leading to overstocking, logistics issues leading to materials damage, improper supervision leading to loss of materials, poor materials tracking system, improper site layout leading to frequent movement of materials, stealing and loss of construction materials, materials shipment, poor shipment time, wrong choice of materials for construction, poor materials buying ability of the project managers, materials payment delay problems, and inflation. Poor planning of construction materials and transportation-related problems which often leads to shortage or lack of materials on-site; were found to be among the major factors affecting materials management (Kazaz et al., 2008). According to Rivas et al. (2011), the principal causes of ineffective material management of construction site are; late delivery of materials meant for construction, materials unavailability prior to starting of actual construction and materials not being stored close to the where they are needed. Ineffective quality control and lack of management and control of materials were found to be part of the cause of inefficient materials management (Zhang, 2014). It was further revealed that excessive inventory, incorrect encoding, and a range of wide materials; are the main contributors to ineffective materials management by Chinese SMEs.

Takim and Akintoye (2002) identified inappropriate materials delivery, improper storage and need for large storage areas, non-compliance with the specification, use of manual process as key issues that affect the performance of construction organisations on construction sites. Jusoh et al. (2018) assessed the factors influencing effective materials management in construction projects in Malaysia. The study found that in the Malaysian construction industry, the influential factors for ensuring that materials are effectively managed are management, purchasing, expediting, transportation, site storage and condition, supplier, contractual and governmental interference. Jusoh and Kasim (2017) carried out a review of the influential factors affecting materials management on construction projects and identified 47 factors that were classified into; site condition, planning and handling on-site, management, materials, supplier and manufacturer default, transportation, contractual and governmental interferences.

Arijeloye and Akinradewo (2016) found that lack of proper work planning and scheduling, inadequate cash flow to contractors due to delayed payments, burglary, theft and vandalism are the factors militating again effective material management. Furthermore, the careless handling of construction materials on site was blamed on the activities of the engineers, site supervisors and planning and purchase department, as well as the contractor's organisations. Consequently, the contractor's organisation usually experience loss/reduced profit.

Following a detailed literature review, 53 factors that trigger inefficient material management were selected and summarized in Table 3.

Table 3 Triggers of inefficient material management practices by construction SMEs

S/N	Triggers of inefficient material management	Sources
1	Transportation and logistics problems	Zakeri et al. (1996); Kazaz et al. (2008); Kasim (2008); Phu and Cho (2014); Kulkarni et al. (2017); Gulghane and Khandve (2015); Jusoh and Kasim (2017)
2	Poor materials handling on site	Zakeri et al. (1996); Kasim (2008); Phu and Cho (2014); Sawalhi and Kass (2012); Jusoh and Kasim (2017); Kulkarni et al. (2017)
3	Abuse of materials specification	Zakeri et al. (1996); Phu and Cho (2014); Jusoh and Kasim (2017)
4	Wrong material specification	Gulghane and Khandve (2015); Jusoh and Kasim (2017); Patel and Vyas (2011)
5	Poor work execution and handling plan	Zakeri et al. (1996); Kazaz et al. (2008); Teni (2013); Phu and Cho (2014); Jusoh and Kasim (2017); Gulghane and Khandve (2015); Arijeloye and Akinradewo (2016)
6	Over-dependence on paperwork	Zakeri et al. (1996); Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Em (2010); Rivas et al. (2011); Phu and Cho (2014); Jusoh and Kasim (2017)
7	Incorrect material delivery	Navon and Berkovich (2006); Kasim (2008); Kazaz et al. (2008); Kasim and Em (2010); Rivas et al. (2010); Kasim (2008); Phu and Cho (2014); Patel and Vyas (2011)
8	Defects of materials from manufacture	Sawalhi and Kass (2012); Phu and Cho (2014); Jusoh and Kasim (2017)
9	Damaged materials on site	Dey (2001); Kasim (2008); Sawalhi and Kass (2012); Patel and Vyas (2011)
10	Unavailability of materials prior to the start of actual construction	Kasim (2008); Rivas et al. (2011); Teni (2013)
11	Poor materials storage system	Navon and Berkovich (2005); Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011); Kasim (2008); Patel and Vyas (2011); Phu and Cho (2014); Teni (2013)
12	Storage facility located too far from the site	Sawalhi and Kass (2012); Rivas et al. (2011)
13	Fluctuation in the prices of materials	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
14	Faulty materials ordering	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
15	Uncoordinated and disorder in the flow of materials	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
16	Wrong materials sorting	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
17	Inadequate equipment	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
18	Regular breakdown of equipment	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
19	Poor inventory and nonexistence of materials status report	Navon and Berkovich (2005); Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Em (2010); Rivas et al. (2011); Sawalhi and Kass (2012)
20	Poor materials coordination	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
21	Late or delay in materials delivery	Dey (2001); Navon and Berkovich (2006); Aibinu and Odeyinka (2006); Abdul-Rahman et al. (2006); Kasim (2008); Kazaz et al. (2008); Kasim and Em (2010); Rivas et al. (2011); Patel and Vyas (2011)
22	Ineffective communication among stakeholders	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2010); Kulkarni et al. (2017); Patel and Vyas (2011); Jusoh and Kasim (2017).
23	Delay in procuring construction materials	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
24	Poor layout of materials handling	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
25	Multiple handling of materials	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011); Teni (2013); Sawalhi and Kass (2012); Gulghane and Khandve (2015)
26	Poor materials planning	Navon and Berkovich (2006); Kazaz et al. (2008); Kasim and Ern (2010); Rivas et al. (2011)
27	Theft, pilfering, burglary and vandalism	Patel and Vyas (2011); Phu and Cho (2014); Gulghane and Khandve (2015), Arijeloye and Akinradewo (2016)

28	Incomplete drawing design and specification	Phu and Cho (2014); Patel and Vyas (2011)
29	Wrong take-off of materials from contract drawings	Dey (2001); Abdul-Rahman et al. (2006); Aibinu and Odeyinka (2006)
30	Improper supervision leading to loss of materials	Phu and Cho (2014); Gulghane and Khandve (2015)
31	Poor materials buying ability of the project managers	Gulghane and Khandve (2015)
32	Materials payment delay problems	Gulghane and Khandve (2015); Arijeloye and Akinradewo (2016)
33	inflation and price fluctuation	Phu and Cho (2014); Gulghane and Khandve (2015); Kulkarni et al. (2017)
34	Wastes due to negligence	Zakeri et al. (1996); Jusoh and Kasim (2017)
35	Delay due to rejection of materials from quality control team	Kulkarni et al. (2017)
36	Seasonal problems	Kulkarni et al. (2017)
37	Labour strike	Kulkarni et al. (2017)
38	Poor materials cutting	Sawalhi and Kass (2012)
39	Incomplete instruction on how materials are to be handled	Sawalhi and Kass (2012)
40	Poor contractors' technical staff qualification	Sawalhi and Kass (2012)
41	Delivery of materials at the wrong time	Navon and Berkovich (2005)
42	Wrong material quantity	Navon and Berkovich (2005)
43	Disparity between the specification of purchase-order	Navon and Berkovich (2005)
44	Omission of required (ordered) materials	Navon and Berkovich (2005)
45	Lack of information on the status of orders	Navon and Berkovich (2005)
46	Lack of complete information on stock	Navon and Berkovich (2005)
47	Absence of up-to-date information on materials delivery	Navon and Berkovich (2005)
48	Surplus of materials delivery	Navon and Berkovich (2005)
49	Pre-mature delivery of materials on site	Dey (2001); Kasim (2008)
50	Design changes at the construction stage	Dey (2001)
51	Inadequate loading area	Kasim (2008)
52	Lack of use of technology of managing materials	Kasim (2008); F. H. Ahmed (2017)
53	Rework due to improper quality and mistakes	Phu and Cho (2014)

3.0 METHODOLOGY

The study set out to assess the factors that trigger inefficient materials management practices by construction SMEs. The study was carried out in Port Harcourt, Rivers state. The premise for selecting River state is that it is among the oil-rich States of Nigeria. It has Port Harcourt as its' state capital and administrative headquarters. According to Moodley (2019), Port Harcourt is the largest city and capital of Rivers state; it is the economic nerve centre of Nigeria's oil industry, and one of her driving industrial centres. Thus, the city is the fastest-growing city in the Niger-delta region of Nigeria. Port Harcourt harbours a lot of building, civil and heavy engineering construction and oil servicing firms. A lot of construction projects are going on in Port Harcourt; these include roads, buildings projects of both residential and commercial nature, dredging, among others. Obunwo (2016) posits that Port Harcourt houses the head offices of many construction firms. The presence of oil and other business opportunities attract a lot of investors, professionals and developers to the state capital (Port Harcourt). The availability of a lot of both building and civil engineering construction and other developmental projects being undertaken by the government of the day within and around Port Harcourt, also attract professionals and artisans alike. Thus, the presence of many small and medium firms and professionals in Port Harcourt, implies that there is the possibility of having a high number of respondents from which data that will aid this study can be obtained. Construction SMEs were chosen for this study because of their contribution to national economic growth. Construction SMEs create jobs, contribute to improving the standard of living of the citizenry, and they drive innovation and sustain healthy competition in the construction market (John et al., 2019). Also, SMEs have higher numerical strength and spread than large construction organisations. They operate with lesser resources and there is less bureaucratic decision-making process by their managers when compared with the large organisations. In order to sustain these huge benefits, there is the need to assess the triggers of ineffective material management which has been found to be one of the killers of SMEs in Nigeria.

This study adopted a questionnaire for data collection and can, therefore, be said to be quantitative. The population of this study is construction professionals, procurement officers, project managers working with construction SMEs. These construction professionals are registered Quantity Surveyors, Engineers, Builders and Architects practising within the study area and having the requisite experience for managing people, materials and other resource and construction site activities. Also, these professionals form the bulk of the key built environment experts' employees of both the contracting and sub-contracting organisations. Related studies such as Teni (2013), Phu and Cho (2014), and Arijeloye and Akinradewo (2016), sampled the same category of professionals.

Table 4 shows the number of MSMEs and the proportion of these enterprises that are into construction works. Using the total number of SMEs in rivers state which is about 1800 equivalent to 2.46% of the total of small and medium enterprises, the number of SMEs (18 for small, 3 for medium) was determined. The total population of construction professionals and procurement officer and project managers sampled are 135. This was based on the assumption that 5 people will be sampled from the small enterprise and 15 from the medium enterprise. This small number of SMEs in river state calls for concern. National Bureau of Statistics (2019) of Nigeria reported a -45.1% decline in the number of SMEs in river state. The reasons for this decline would require a further reflection and beyond the scope of this study. The sample population of 135 was equally adopted for sample size.

Table 4 Sample population and size

			Construction business		Construction SMEs in Rivers State		Sample population	
Enterprise type	**Number of each type**	**Per cent proportion**	**% Proportion in the country**	**Number of each involved in construction business**	**The proportion of SMEs Rivers State about 1800 (2.46%)**	**Number of each**	**Number of professionals to be sampled**	**Total Number to be Sampled**
Micro	41,469,947.00	99.82%	2.2%	912,338.83				
Small	71,288.00	0.17%	1.0%	712.88	2.46%	18	5	90
Medium	1,793.00	0.00%	5.0%	89.65	2.46%	3	15	45
Total	**41,543,028.00**			**913,141.36**				**135**

(Source**:** National Bureau of Statistics, 2019)

A convenient sampling technique was used in the administration of the research instrument for the purpose of collecting data. This sampling technique was use purposively for achieving the research aim and ensuring that experienced employees attend to the questionnaires. Amade et al. (2016) posit that convenience sampling is a technique that allows the researcher(s) to survey respondents based on his/their convenience. Oke et al. (2020) advocated for the consideration of practical work experience of a researcher in construction-related activities for the selection of survey participants when using convenient sampling. The questionnaires were administered by the researchers themselves and some selected and trained research assistants that have been adequately brief regarding the subject under consideration in order to avoid errors.

The questionnaire was divided into two parts. Part A contains questions about respondents' profile and organisational background. Part B contains questions on the factors that trigger inefficient material management practices by construction SMEs. The questionnaire used asked questions on a 5-point Likert scale with 1 being the lowest and 5 the highest of the ranking. The Likert scale was adopted since it is considered a wonderful technique of assessing respondents' attitude towards an attribute. Besides, it is simple to use and the level of ambiguity, mistake and confusion is reduced (Manu, 2015). The questions required the respondents to rate the level of contribution of the selected triggers of inefficient material management on a 5-point Likert scale: where 1 = very low contribution, 2 = low contribution, 3 = average contribution, 4 = high contribution and 5 = very high contribution. The initial draft of the questionnaire was pre-tested through a pilot study to ascertain that the questions are clear, effective and intelligible. The final draft was made following the feedback from the pilot survey.

Out of the 135 questionnaires administered, a total of 126 were retrieved. None was discarded as the entire 126 returned were completely and correctly filled and were subsequently used for the analysis as they were deemed adequate. This 126 represent an effective response rate of 93.33% which is far above the response rate that has been reported in some construction-related studies that used questionnaire. This high response rate obtained in this study is due to the fact that it took about 3 months and 3 weeks for the data collection to be completed. Also, the regular follow-up visits and calls placed across to a good number of the participants.

Data collected were analysed using percentages, frequencies, and factor analysis. The respondents' general information was analysed using frequencies and percentage. Data obtained on factors that trigger inefficient material management were analysed using Factor analysis to group them into more manageable proportion and size. These analyses were performed using (SPSS 20, IBM).

To determine how reliable, consistent, and how valid the gathered data and research instrument are, a Cronbach's Alpha test for reliability analysis was carried out. According to Letarge et al. *(*2016), the reliability of a research instrument is the measures of the accuracy and precisions of the adopted measurement procedure; this test normally will give the Cronbach's alpha value which should not be less than 0.50. It was earlier opined by Oyedele et al. (2003) that an alpha value of 0.7 and above implies higher and better reliability and consistency of the research instrument. Trizano-Hermosilla and Alvarado (2016) posit that the commonly accepted technique for determining the interior consistency and reliability of a study is by using the Cronbach's alpha (α) value. The inward reliability shows the degree of relatedness of compared thoughts or constructs between and inside the things in test measures (Tavakol & Dennick, 2011). According to Aghimien et al. (2018a), the normal range of Cronbach's α value is between 0 and 1, and the higher the value, the higher the degree of internal consistency. Prior to actual data analysis, this study conducted a reliability analysis and found that the study has high internal consistency, as the Cronbach's alpha (α) obtained is 0.905 and this is above the recommended value (see Table 5). This reflects a very good reliability level as it fell within the range (0.80-0.95) proposed by (Kasim et al., 2019).

Table 5 Reliability analysis

Case Processing Summary				Reliability Statistics	
		N	**%**	**Cronbach's Alpha (α)**	**N of Items**
Cases	Valid	126	100		
	Excluded[a]	0	0	0.905	53
	Total	126	100		

a. Listwise deletion based on all variables in the procedure.

4.0 RESULTS AND DISCUSSION

4.1 General Information of Respondents

The result displayed in Table 6 evolves from the analysis of the respondents' general information. The result shows that majority of the respondents (65.08%) work with small size construction organisations while the remaining (34.92%) work with medium size construction firms. The result of the participants' profession and responsibilities revealed that Engineers (27.78%) are more, followed by Quantity Surveyors (19.05%), this is followed by Architects (17.46%), then project managers (16.67%), then builders (11.90%) and lastly procurement officers (7.14%). In terms of the respondents' working experience, the result shows that those who have years of experience within the range 6-10 years are more by 29.37%, followed by 11-15 years by 23.81%, followed by 1-5years who had 16.61%, then 16-20 years with 15.87%, and lastly those with experience above 20 years with 14.29%. The average working experience of the respondents was put at approximately 11.58 years. The implication is that the respondents have gained enough experience in the construction industry to give dependable responses that will aid the study.

In terms of academic qualification, those with Bachelor's degree (B.Sc/B.Tech) are more with 34.92%, followed by Master's degree holders (M.Sc/M.Tech) with 27.78%, followed by Post Graduate Diploma holders (PGD) with 21.43%, then those with higher National Diploma (HND) with 11.90% and lastly, those with Doctorate of philosophy, PhD with 3.97%. The result further indicated that the type of building projects they were involved in is residential buildings with 70.63% and the remaining 29.37% are involved in non-residential building projects. Based on the result obtained in this section, it can be said that the respondents are professionally, academically armed with the right work experience to give dependable and reasonable information to aid meeting the study aim.

Table 6 Demographic characteristics of respondents

Category	Classification	Freq.	Percent	Valid Percent	Cum. Percent
Category of organisation	Small	82	65.08	65.08	65.08
	Medium	44	34.92	34.92	100.00
	TOTAL	**126**	**100.00**	**100.00**	
Respondents profession/responsibility	Architects	22	17.46	17.46	17.46
	Builders	15	11.90	11.90	29.37
	Engineers	35	27.78	27.78	57.14
	Quantity surveyors	24	19.05	19.05	76.19
	Project managers	21	16.67	16.67	92.86
	Procurement officers	9	7.14	7.14	100.00
	TOTAL	**126**	**100.00**	**100.00**	

Years of experience	1-5years	21	16.67	16.67	16.67
	6-10 years	37	29.37	29.37	46.03
	11-15years	30	23.81	23.81	69.84
	16-20 years	20	15.87	15.87	85.71
	Above 20	18	14.29	14.29	100.00
	TOTAL	**126**	**100.00**	**100.00**	
highest academic qualification	HND	15	11.90	11.90	11.90
	PGD	27	21.43	21.43	33.33
	B.Sc/B.Tech	44	34.92	34.92	68.25
	M.Sc/M.Tech	35	27.78	27.78	96.03
	PhD	5	3.97	3.97	100.00
	TOTAL	**126**	**100.00**	**100.00**	
Area of building project type involved	Residential building	89	70.63	70.63	70.63
	Others: Non-residential	37	29.37	29.37	100.00
	TOTAL	**126**	**100.00**	**100.00**	

4.2 Factor Analysis of the Triggers of Inefficient Material Management among Construction SMEs

Initially, 53 factors that trigger inefficient materials management were selected from an extensive literature review. These factors were subsequently reduced to 40 following an initial test of suitability and factors analysis. These 13 variables were excluded from further analysis as the communalities values obtained were below 0.50. This is in response to Costello and Osborne's (2005) suggestion. It was suggested that variables with communalities figure of ≤ 0.4, should be eliminated from further analysis when using factor analysis. Furthermore, Eze et al. (2018b) posit that it is only variables with communalities figure of ≥ 0.5 that can fit well with other variables in the structure of the components. Therefore, regardless of the sample size, a communalities value of 0.60 and above is suitable (Zhao, 2008).

The remaining 40 variables were subjected to further analysis to ascertain their suitability and adequacy for factor analysis. The sample size of 126 was within the recommended suggestions of (Mundfrom et al., 2005; Pallant, 2007; Tabachnick & Fidell, 2007). However, with the high communalities values, the sample size is of no effect (Preacher & MacCallum, 2002). Furthermore, there is no agreement as to what the ideal number of variables should be as observed in studies of (Aghimien et al., 2018a; Aghimien et al., 2018b; Hair et al., 1998). A further Cronbach's alpha value of 0.846 obtained indicates high reliability and internal consistency.

Based on these, it can reliably be affirmed that the 40 triggers and the 129 sample size are adequate and satisfactory for factor analysis. Also, the average communalities value of 0.817, with a maximum of 0.980 and minimum of 0.723, shows that the variables and sample size are adequate and supports the decision (see Table 7).

Table 7 Communalities for the inefficient material management triggers

S/N	Variables	Initial	Extraction
1	Transportation and logistics problems	1	0.898
2	Poor materials handling on site	1	0.761
3	Abuse of materials specification	1	0.844
4	Over-dependence on paperwork	1	0.781
5	Incorrect material delivery	1	0.867
6	Defects of materials from manufacture	1	0.801
7	Damaged materials on site	1	0.794
8	Unavailability of materials prior to the start of actual construction	1	0.723
9	Poor materials storage system	1	0.825
10	Storage facility located too far from the site	1	0.844
11	Faulty materials ordering	1	0.729
12	Inadequate equipment	1	0.752
13	Regular breakdown of equipment	1	0.869
14	Poor inventory and nonexistence of materials status report	1	0.788
15	Poor materials coordination	1	0.908
16	Late or delay in materials delivery	1	0.837
17	Ineffective communication among stakeholders	1	0.833
18	Delay in procuring construction materials	1	0.832

19	Poor layout of materials handling	1	0.85
20	Multiple handling of materials and	1	0.866
21	Poor materials planning	1	0.767
22	Theft, pilfering, burglary and vandalism	1	0.897
23	Incomplete drawing design and specification	1	0.803
24	Wrong take-off of materials from contract drawings	1	0.817
25	Poor materials buying ability of the project managers	1	0.765
26	Wastes due to negligence	1	0.729
27	Seasonal problems	1	0.804
28	Labour strike	1	0.759
29	Incomplete instruction on how materials are to be handled	1	0.787
30	Delivery of materials at the wrong time	1	0.809
31	Wrong material quantity	1	0.853
32	Disparity between the specification of purchase-order	1	0.795
33	The omission of required (ordered) materials	1	0.867
34	Lack of information on the status of orders	1	0.851
35	Absence of up-to-date information on materials delivery	1	0.802
36	Surplus of materials delivery	1	0.798
37	Pre-mature delivery of materials on site	1	0.834
38	Design changes at the construction stage	1	0.841
39	Inadequate loading area	1	0.841
40	Rework due to improper quality and mistakes	1	0.870

Having examined the adequacy of the variables and sample size, another thing is to examine the values of Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. KMO and Bartlett's test of sphericity is used to test the factorability of data for factors analysis. To proceed with factor analysis, a KMO of ≥ 0.50 is large and adequate. Thus, an adequate value of KMO range from 0.50 to 0.70, but a value of less than 0.50 is adjudged inappropriate for factor analysis. While, the ideal value for factor analysis for Bartlett's test of sphericity is a p-value that is below 0.05. According to Eze et al. (2018b), variables can be said to have a patterned relationship when the significant level of p (Sig.) < 0.05. The variables considered in this analysis met these conditions as shown in Table 8.

Table 8 KMO and Bartlett's test for triggers of inefficient material management

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.712
Bartlett's Test of Sphericity	Approx. Chi-Square	4496
	df	780
	Sig.	0

After establishing the suitability and adequacy of the data, factor analysis was conducted using principal component analysis (PCA) with varimax rotation as the extraction method. From Table 9 it can be seen that 11 components with eigenvalues greater than one (1) were retained. SPSS utilises the Kaiser criterion and ordinarily would retain components with eigenvalue of ≥ 1 (Pallant, 2007). According to Spector (1992), a clear component structure exists when the factor loading of variables is ≥ 0.5. With a combination of Kaiser criterion and factor loading of ≥ 0.5, 11 components were initially retained.

Table 9 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.905	17.262	17.262	6.905	17.262	17.262
2	5.448	13.62	30.882	5.448	13.62	30.882
3	4.309	10.772	41.654	4.309	10.772	41.654
4	3.145	7.862	49.516	3.145	7.862	49.516
5	2.849	7.123	56.64	2.849	7.123	56.64
6	2.7	6.749	63.389	2.7	6.749	63.389
7	1.53	3.824	67.213	1.53	3.824	67.213
8	1.471	3.678	70.891	1.471	3.678	70.891
9	1.145	2.864	73.755	1.145	2.864	73.755
10	1.049	2.622	76.376	1.049	2.622	76.376
11	1.023	2.559	78.935	1.023	2.559	78.935

Hence, the 11 components retained are too much using Kaiser's criterion, and according to Pallant (2007), the Kaiser's criterion is widely criticized because of this. A critical examination of the scree plot and component matrix was suggested by Pallant (2007), when making a decision on the number of components (factors) to retain/extract.

The examination of the scree plot is by looking at the point where a change (or elbow) occurs in the shape of the plot. This point should be identified and components above this point are retained. Costello and Osborne (2005) advocated for the exclusion of the component at which the break occurs. The break occurred at the 8th component (see fig. 4), and thus, only 7 variables (points) above this elbow are considered. With these 7 components retained, it can be said that they captured much of the variance than the remaining components (i.e. 67.21% against 11.72%). Thus, only the first 7 components were considered; according to Pallant (2007), there is no statistical hard and fast rule for considering the remaining components.

To further support this decision of retaining 7 items, the Component Matrix was examined. It was observed that only 7 components have items loading of 3 and above. The remaining 4 components have items loading of 2 and 1 and even none. Pallant (2007) opined that the ideal number of items loading needed of a component should be from three (3) or more. Weak and unstable components have < 3 items on them. Costello and Osborne (2005) posit that strongly loading items of 5 or more, with a factor loading of 0.5 and above indicates desirable solid factors.

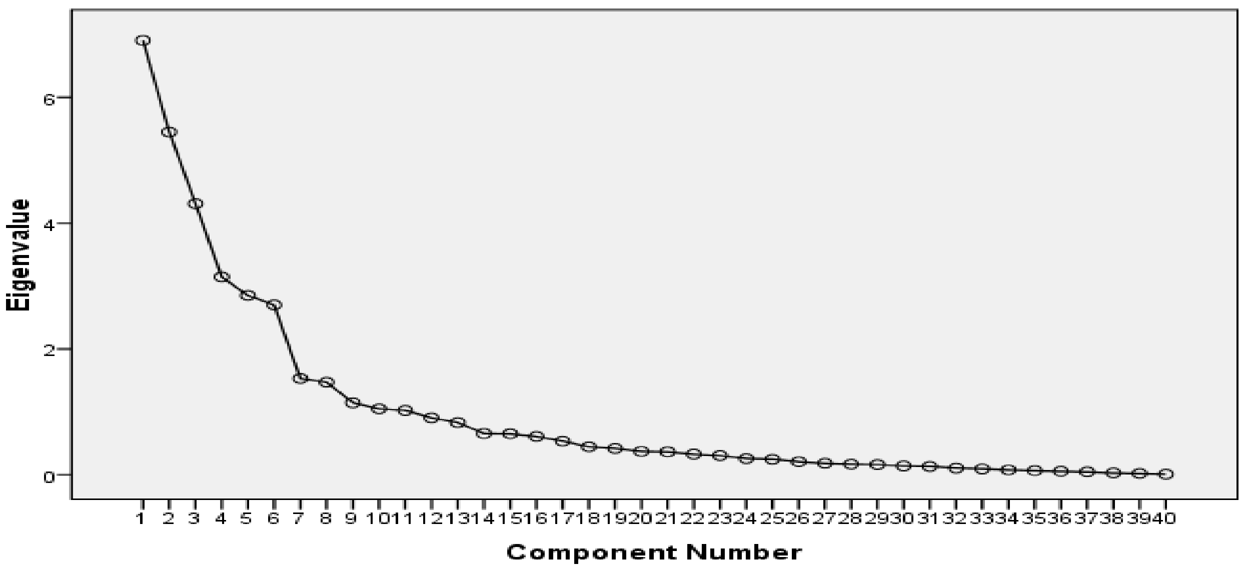

Figure 4 Scree plot

4.2.1 Principal Component Analysis and Factor Extraction

Following the aforementioned considerations and the decision to retain seven (7) components, varimax rotation was repeated with the number of factors set at seven (7), and with a cut-off point of 0.50. The result that follows is shown on table 10. The total variance explained of each component extracted is as follows; component 1 accounted for 17.26%, component 2 (13.62%), component 3 (10.77%), component 4 (7.86%), component 5 (7.12%), component 6 (6.75%) and component 7 (3.82%). The final statistics of the PCA and the components extracted accounted for approximately 67.21% of the total cumulative variance with an Eigenvalue larger than 1. Thus, Pallant's (2007) criterion of factors explaining at least 50% of the total variance is fulfilled.

Table 10 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.905	17.262	17.262	6.905	17.262	17.262	5.257	13.143	13.143
2	5.448	13.62	30.882	5.448	13.62	30.882	5.239	13.098	26.241
3	4.309	10.772	41.654	4.309	10.772	41.654	4.113	10.281	36.523
4	3.145	7.862	49.516	3.145	7.862	49.516	3.439	8.597	45.119
5	2.849	7.123	56.64	2.849	7.123	56.64	3.393	8.482	53.601
6	2.7	6.749	63.389	2.7	6.749	63.389	2.738	6.845	60.446
7	1.53	3.824	67.213	1.53	3.824	67.213	2.707	6.767	67.213

The result in Table 11 summarized the factor loading on each of the seven (7) extracted components and their variables. According to Spector (1992), the presence of variables with significant factor loading of 0.50 or more under a component, is an indication of strong component structure. Based on this, the elements considered and retained under each of the components have factor loading of 0.50 and above.

Table 11 Rotated component matrix[a]

	Component						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Over-dependence on paperwork	0.790						
Regular breakdown of equipment	0.754						
Inadequate equipment	0.748						
Poor materials handling on-site	0.723						
Delay in procuring construction materials	0.656						
Unavailability of materials prior to the start of actual construction	0.629						
Poor materials planning	0.619						
Wastes due to negligence	0.603						
Disparity between specification of purchase-order	0.527						
Faulty materials ordering	0.523						
Defects of materials from manufacture		0.763					
Pre-mature delivery of materials on site		0.721					
Poor materials coordination		0.718					
Design changes at construction stage		0.649					
Late or delay in materials delivery		0.648					
Lack of information on the status of orders		0.629					
Damaged materials on site		0.567					
Labour strike		0.516					
Storage facility located too far from the site		0.510					
Poor inventory and nonexistence of materials status report			0.787				
Surplus of materials delivery			0.747				
Multiple handling of materials			0.73				
Transportation and logistics problems			0.706				
Rework due to improper quality and mistakes			0.599				
Poor layout of materials handling			0.584				
Omission of required (ordered) materials				0.856			
Poor materials buying ability of the project managers				0.714			
Delivery of materials at the wrong time				0.688			
Incomplete drawing design and specification				0.514			
Wrong material quantity					0.771		
Wrong take-off of materials from contract drawings					0.611		
Incomplete instruction on how materials are to be handled					0.549		
Seasonal problems					0.534		
Poor materials storage system						0.786	
Theft, pilfering, burglary and vandalism						0.685	
Abuse of materials specification						0.617	
Incorrect material delivery						0.616	
Ineffective communication among stakeholders							0.703
Inadequate loading area							0.681
Absence of up-to-date information on materials delivery							0.635

4.2.2 Significant Findings

The first principal component had the highest factor loading that accounted for about 17% of the total variance explained. These variables include; over-dependence on paperwork, regular breakdown of equipment, inadequate equipment, poor materials handling on-site, delay in procuring construction materials, unavailability of materials prior to the start of actual construction, poor materials planning, wastes due to negligence, disparity between the specification of purchase-order, and faulty materials ordering. After critically examining the latent characteristics of these factors, it was found to be related to the traditional system of managing materials and maintenance challenges. Thus, the component was named '*Traditional approach and maintenance issues'*.

The second principal component had nine factors loading that accounted for about 14% of the total variance explained. The factors loading on this component are; defects of materials from manufacture, pre-mature delivery of materials on-site, poor materials coordination, design changes at the construction stage, late or delay in materials delivery, lack of information on the status of orders, damaged materials on-site, labour strike, and storage facility located too far from the site. An examination of these showed they are related to Errors during manufacture and defective planning. It is based on these that, this component was subsequently named '*Manufacturer error and poor planning'*.

The third principal component accounts for about 11% of the total variance explained. The factors loaded on this component include; poor inventory and nonexistence of materials status report, surplus of materials delivery, multiple handling of materials, Transportation and logistics problems, rework due to improper quality and mistakes, and poor layout of materials handling. Examination of the latent characteristics of these variables shows they are related to issues of inventory management and based on these; it was named '*inventory management issues'.*

The fourth principal component had factor loading that accounted for about 8% of the total variance explained. The factors loading on this component are; omission of required (ordered) materials, poor materials buying ability of the project managers, delivery of materials at the wrong time and incomplete drawing design and specification. A critical examination of these variables showed they are related to procurement handling issues. Based on this, the component was subsequently named '*Poor handling of procurement'*.

The fifth principal component accounts for about 7% of the total variance explained. The factors loaded on this component include; wrong material quantity, Wrong take-off of materials from contract drawings, incomplete instruction on how materials are to be handled, and seasonal problems. Examination of the latent characteristics of these variables shows they are related to problems associated with materials estimating. It is based on this that the component was named 'materials estimating problems'.

The sixth principal component had factor loading that accounted for about 6.8% of the total variance explained. The factors loading on this component are; poor materials storage system, theft, pilfering, burglary and vandalism, abuse of materials specification, and incorrect material delivery. After looking at the latent features of these variables, which are related to insecurity and storage challenges; this component was named '*storage problems and insecurity'.*

The seventh principal component accounts for about 4% of the total variance explained. The factors loaded on this component include; ineffective communication among stakeholders, Inadequate loading area, and absence of up-to-date information on materials delivery. This component was named '*communication issues'*, after the examination of the latent characteristics of the variables that were loaded under the component.

Factor analysis revealed that the major triggers of inefficient materials management are; Traditional approach and maintenance issues, manufacturer error and poor planning, inventory management issues, poor handling of procurement, materials estimating problems, Storage problems and insecurity, and communication issues. This result supports the findings of (Jusoh & Kasim, 2017; Jusoh et al., 2018; Kulkarni et al., 2017; Patel & Vyas, 2011). Patel and Vyas (2011) reported that improper storage facility and purchase of less of the estimated materials affect material management. Jusoh and Kasim (2017) and Jusoh et al. (2018) found that the causes of material management inefficiency are; site condition, planning and handling on-site, management, materials, supplier and manufacturer default, transportation, contractual and governmental interferences. Kulkarni et al. (2017) identified transportation problems, seasonal problems, labour strike, communication problems, improper handling and lack of material management, as among the major cause of materials management problems.

The result of this study is also, in line with the findings of (Arijeloye & Akinradewo, 2016; Gulghane & Khandve, 2015; Navon & Berkovich, 2005; Phu & Cho, 2014; Sawalhi & Kass, 2012). Arijeloye and Akinradewo (2016) found that lack of proper work planning and scheduling, burglary, theft and vandalism are the factors militating against effective material management. Phu and Cho (2014) also found that transportation problems, poor materials handling on-site, abuse materials specification, poor work plan, over-reliance on paperwork and incorrect material delivery, were the factors that cause ineffective materials management. The factors that can hamper materials management efforts are; defective materials (manufacturing faults), damaged materials on-site, poor materials cutting, double handling of materials transport, incomplete instruction on how materials are to be handled, poor handling of materials on-site, storage facility located too far from the site, poor materials buying ability of the project managers, stealing and loss of construction materials, improper supervision leading to loss of materials, improper planning leading to overstocking, and logistics issues leading to materials damages (Gulghane & Khandve, 2015; Sawalhi & Kass, 2012). Material tracking problems and unavailability updated information on the stock are material management problems (Navon & Berkovich, 2005; Sawalhi & Kass, 2012).

It is obvious, that the traditional method which involves too much paper works will be impracticable to be discarded from the construction industry's activities. This is not only on materials management but also on other project activities. This has been blamed on resistance to change and the slow pace of adoption of ICT facilities in construction generally. According to Patel and Vyas (2011), there is no automation in the management of materials. Planning which is a key for successful project delivery has remained a problem. Poor planning leads to errors not only on the side of the manufacturers but also on the sides of the contractors, sub-contractors and their teams. Poor planning and location of storage areas, storage space inadequacy and insecurity on most construction sites have remained a problem in managing construction materials. These also lead to wastage, damages, and pilfering. In spite, of the level of innovation in areas of ICT adoption in construction, quantities are still being generated using manual traditional methods. Problems related to communication have remained a recurring decimal in construction not only in the area of managing materials but also in other construction-related activities. Poor communication could result in poor inventory management, wrong delivery and poor handling of procurement. The implication of the results of this study is that construction organisations are faced with the same problems of inefficient material management practices regardless of the size of the firm.

The implication of allowing these triggers to remain on construction projects are delays in delivering work packages, which could result to overall project delays or overrun. Also, when this delay is allowed to persist, costs are involved, leading cost overrun. Quality degradation and reduced productivity are eminent. This is because some contractors or even the sub-contractors would be tempted to manage available materials leading to wastage, reduced quality and waste of productive time. Overall, this leads to dissatisfied client, loss of profits, claims and counterclaims, disputes and loss of future projects (businesses).

■5.0 CONCLUSION

The study set out to assess the factors that trigger inefficient materials management practices among construction SMEs in Nigeria. Using information gathered from project managers, procurement officers, and construction professionals, the study was able to determine the major factors that trigger inefficient materials management.

It was found that the major triggers of inefficient materials management among construction SMEs are; traditional approach and maintenance issues, manufacturer error and poor planning, inventory management issues, poor handling of procurement, materials estimating problems, storage problems and insecurity, and communication issues. Thus, the study concludes that the predominance of these triggers in the management of materials among construction SMEs in Nigeria means that there will be continued poor performance of construction projects, especially with regards to project time, cost, quality and productivity. This could ultimately result in loss of revenue and future businesses and demise. Furthermore, regardless of the construction organisational size, the triggers of inefficient material management are the same. The study recommends thus: A move away from the traditional methods of managing materials and the adoption of a technological-based material management system. This will ensure that procurement and inventory are properly managed. There should be proper planning by both manufacturers of construction materials and the procuring organisations. Quantity surveyors and other estimators should take proper care in ensuring that adequate and reliable quantities of materials are generated for construction work items. Adequate storage facilities and security should be provided. This should start from warehousing until delivery to site and site management continuing. There should be effective and efficient communication among the stakeholders across the supply chain. This will ensure a seamless flow of information across the board.

This study is limited to small and medium construction organisations within the study area, as such further study could be carried out that would consider the micro firms and building materials suppliers. Structural equation model could be used to further establish the pattern relationships that exist among the triggers of ineffective materials management among MSMEs. The status of adoption of innovative ICT facilities in the management of construction materials among Construction SMEs could be researched upon.

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