Effect of COVID-19 pandemic on the cost of building materials in Nigeria

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Abstract: As the world is adjusting from the COVID-19 pandemic, the effects of the virus continue to linger through all segments, construction industry not excluded, both operationally and financially. The substantial growth in the construction industry is subject to the price stability in building materials. Thus, this paper tends to investigate the impact of the COVID-19 pandemic on the cost of building construction materials. Secondary data on the number of cases of the COVID-19 pandemic outbreak and the cost of building materials that covered the duration of the commencement of the outbreak in Nigeria till the end of 2021 were collected. It discovered that there was general increase in the prices of building materials. Spearman Correlation Test was adopted to measure the relationship between COVID-19 pandemic outbreak and cost of the various building materials. The correlation was investigated by the individual materials of cement, sandcrete blocks, high tensile reinforcement bars, earthwork and fine and coarse aggregates. It was revealed that a non-significant positive and negative relationship between the COVID-19 pandemic outbreak and the building materials prices exists, indicating that the change in the cases of COVID- 19 pandemic will not affect the prices. It therefore showed that other factors are responsible for the continuous increase in price of building materials in Nigeria. Some of those factors as established include inflation, exchange rate, import, interest rate, money supply and demand for money. Therefore, it is expedient for government to take extreme measures to reduce the cost of production and transportation of construction materials by ensuring an adequate supply of power from the power sector as against the epileptic power supply and repairs of the local refineries for the production of petroleum products as against dependency on importation.

Key Words: — ***COVID-19, Construction Materials, Building Construction, Pandemic, Nigeria.***

I. INTRODUCTION

The construction sector affects socio-economic expansion development in the developing countries by contributing substantially to their gross domestic product (GDP) (Ofori et al. 2012 and Chen et al. 2017). According to Adedeji (2012), about 60% of total housing expenditure is spent on building materials.

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Construction materials cover all types of material used in construction including electrical and mechanical fittings, fixtures, devices and instruments that are incorporated during the construction of permanent works and temporary supporting works on site. Building materials comprise of a wide range of items that are used in the building industry. Such materials among others include: sand, timber, reinforcement bars, asbestos, roofing sheets and metal. These materials are generally believed to influence the quality and cost of housing products. As such, high-quality building materials must always be used in housing, also in low-cost housing (Bredenoord 2017).

Substantial growth in the construction industry is subject to the price stability in building materials. Similarly, Joseph et.al (2015) stated that price stability is a necessary precondition for a healthy economy.

However, as a result of this, it is crucial for the sector to understand the impact of the building materials cost in completing housing projects as scheduled. Even before COVID-19, there were concerns in the construction industry around the supply chain and costs of construction materials. Client and project contractors have been facing serious issues to maintain steady cost projection on construction projects (Akanni et al. 2014). Maintaining steady cost projection on construction projects had been an issue of serious concern both to the client and project contractors. On the Nigerian scene, Jagboro and Owoeye (as cited by Akanni et al. 2014) found that one of the most serious problems in the Nigeria construction industry is the project cost overrun, with attendant consequences of completing projects at sums higher than the initial sum and concluded that project abandonment ensues in most cases. Azhar, Farooqui, and Ahmed (2008) noticed that the basic reason of cost overruns is that most contractors quote prices based on their projected estimates; unfortunately, the prices change so quickly that the initial budget figures become completely unrealistic.

The COVID-19 pandemic has already brought unprecedented economic and social impacts to many parts of the world and several sectors including, but not limited to, business, schools, travel, tourism, hospitality, aviation, agriculture, petroleum and oil, manufacturing industry and construction industries (Gamil and Alhagar, 2020; Laing 2020; Nicola et al., 2020). The impact of COVID-19 pandemic has been felt through all segments in the construction industry, both operationally and financially (Cherukur et.al as cited by Kushal, and Lochana 2021, Deloitte 2020). As the world adjusts from the COVID-19 pandemic, the effects of the pandemic continue to linger in the construction industry. As Alan Muse FRICS, RICS' Director of Built Environment, observes: "Construction has always been a risky intervention, which deters investment. COVID-19 pandemic has added to this uncertainty, while at the same time governments around the world see construction as an important post-pandemic stimulus measure. Therefore, improving predictability for demanding clients and, as projects become increasingly complex, is key. Predictability in terms of quality and time, but also, critically, in cost and value."

Now that the construction industry is adapting to its new normal, with its increased cost base, productivity and scheduling challenges, many parties are looking forward to addressing the impacts of COVID-19 pandemic upfront in their contracts to the extent possible. More recently, the pandemic has led to job losses and fewer construction projects going ahead because of the hard lockdown. Owing to the high level of concern that the COVID-19 pandemic has generated globally, a lot of studies have been carried out on the problem within the short time that the pandemic has lasted. Some of the studies examined the impact of COVID-19 on economic actitives (Teachout and Zipfel 2020; Maryla et al. 2020). Others examined the impact on the construction industry both in country and outside the country (Alenezi 2020; Gamil et al. 2020; Zamani 2021, Anakan et al. 2021).

However, with so much change and lingering uncertainties, many people in the industry are asking, what will happen to construction pricing? With the rise of pandemic, experts in the fields have shared their opinions on impacts of COVID-19 pandemic on construction industry and construction projects. In addition, many new articles pertaining to COVID-19 pandemic and the coping strategies are being published with little emphasis on the implications especially on cost of material cost in Nigeria. This paper tends to fill the identified gap in other to expand the frontier of knowledge by addressing the impact of the COVID-19 pandemic on the cost of building construction materials.

To achieve this aim, the following objectives have been set out.

- To examine the trend of COVID-19 pandemic increase in Nigeria between 2020 to 2021
- To examine the trend of building construction material, increase in Nigeria between 2020 and 2021
- To identify the relationship between the no of cases of COVID-19 pandemic and the various cost of building construction materials.

H_o- There is no significant relationship between the no of cases of COVID-19 pandemic and the various cost of construction materials.

II. LITERATURE REVIEW

2.1 General view of Covid 19 Pandemic in Nigeria

Coronavirus which was from animal to human first occurred in Wuhan, China in December 2019, since then it has spread rapidly all over the globe through person to person contact in a short time. The World Health Organization declared the COVID-19 as pandemic on 11th March 2020. A pandemic occurs when people don't have the immune power to resist the disease. For over two years and still counting, the entire world came to a standstill with the outbreak of an unprecedented pandemic-tagged COVID-19. The people who are infected by the COVID-19 has faced some symptoms like respiratory illness, fever, dry cough, tiredness, sore throat, aches or pains,

difficulty breathing, chest pain or pressure, etc. the COVID- 19 has been spread primarily through the droplets of saliva or discharge from the nose and it happens when an infected person coughs or sneezes.

In late February 2020, Nigeria recorded the subcontinent's first confirmed case, after which it began to spread throughout Lagos, Ogun State, and the Federal Capital Authority (FCT) area of Abuja then the rest of the country. Nigeria has since implemented strict measures to contain the spread of the virus. The Nigeria Centre for Disease Control (NCDC) through the National Emergency Operations Centre (NEOC) has continued to lead the national public health response in Nigeria with oversight of the Presidential Task Force on COVID-19 (PTF-COVID-19). The NCDC is also working closely with all states of the Federation to support their response activities to the pandemic. At the same time, oil prices plummeted by 60% following the spread of the global pandemic. As the oil sector accounts for the bulk of Nigerian government revenue, this collapse in prices has profound implications for the economy. Adegboye et al (2020) examine the early transmission of COVID-19 pandemic in Nigeria, and show that the COVID-19 cases in Nigeria were lower than expected. Adenomon and Maijamaa (2020) examine the impact of COVID-19 pandemic on the Nigerian stock exchange from 2nd January 2020 to 16th April 2020. The results revealed a loss in stock returns and high volatility in stock returns during the COVID-19 pandemic in Nigeria. It is therefore, concluded that the pandemic has done more harm than good to Nigerian people and the economy as it relates to unpredicted structural behavioural changes and recession that in turn resulted in hunger and poverty and deaths. The COVID-19 pandemic has done a lot of damage to society. It has affected the society as well as the economy of every country of which Nigeria is inclusive. Nearly every industry felt the effects. The uncertainties with regard to this pandemic have affected construction. Heavy & civil engineering sector was no exception. Projects were postponed, placed on hold, or cancelled. Construction unemployment started to skyrocket, leaving many wonderings how the industry might be affected both short and long term. As a result, the COVID-19 pandemic crisis has led to the need for industry members to address both short-term and long-term business challenges, as well as formulating project-by-project solutions in the face of a new global and national environment.

Safe and effective COVID-19 vaccines are a game-changing tool in the fight against the pandemic, but for now, we must keep wearing masks, washing our hands, ensuring good ventilation indoors, physically distancing and avoiding crowds. This is because with a fast-moving pandemic, no one is safe until everyone is made safe by vaccination, and Nigeria must not be left behind. Vaccines mimic our body's natural response to infection. However, while a previous infection does give you some immunity against COVID-19, vaccination gives your body a massive immune boost – including against new variants. The fight against COVID-19 has seen vaccine development move at record speed, with more than 170 different vaccines in trials. There are four categories of vaccines in clinical trials: whole virus, protein subunit, viral vector and nucleic acid (RNA and DNA). Some of them try to smuggle the antigen into the body, others use the body's own cells to make the viral antigen. The Nigerian national vaccination programme started in March 2021 and is using the AstraZeneca and Pfizer-BioNTech vaccines.

2.2 Building Construction materials

Building materials are various substance or items that form the basic components of various elements of a building. According to some researchers, building materials play a pivotal role in building as a substantial input in the project development (Akani et al. 2014). They have been playing an important role in the construction industry—they are those materials put together in erecting or constructing structures, no field of engineering is conceivable without their use. Building materials account for approximately 60% of the total cost of building projects (Idowu and Winston, 2018). The large proportion of building materials in construction project costs make it an important component, which has an enormous effect on the cost of construction and essentially the affordability of newly proposed construction projects. It commonly includes steel, copper, cement, bitumen, lumber, masonry bricks/blocks, and sand among many others. Building materials contribute immensely to the quality and cost of housing, from what is used in the foundation to the materials for roofing and finishes, while the building materials industry is an important contributor to the national economy of any nation as its out-put governs both the rate and the quality of construction.

The construction industry is very important, as it uses larger quantities of materials than any other industry (Osotimehin 2006). Based on this, it is necessary that the materials used should be affordable otherwise building would be very much more expensive. The prices of building materials increase on a daily basis, due to instability of the Naira to the Dollar and general inflationary trends. A study by Ugochukeu et al. (2017) conclude that government policy of devaluation of the Naira

accounts for the increase in the price of building materials in Nigeria.

Cement: Lovely (2013) describes cement as material having both adhesive and cohesive properties that enables it to form a good bond with other materials. There are five major types of cement and they are Natural cements, Roman cement, High allumina cement, Super sulphated cement and Portland cement. Portland cement of different manufacturers is used in Nigerian building industry. They come in five (5) different classifications depending on the physical and chemical properties. There are many types of Portland cement but the most widely used in the Nigerian building industry is ordinary Portland cement and this is because it is the cheapest and most available cement with a medium rate of hardening, thus making it suitable for most concrete works.

Blocks /Concrete blocks: There are various types of blocks; the most common in Nigeria is sandcrete blocks. Over 90% of physical infrastructures in Nigeria are being constructed using sandcrete blocks (Baiden and Tuuli, as cited by Anosike and Oyebade, 2012). This makes sandcrete blocks a very important material in building construction. They are of many types depending on the constituent materials. The constituents also determine the structural characteristics of the blocks. The major types are sandcrete blocks (water, cement and river sand), soilcrete blocks (water, cement and laterite), concrete blocks, bricks (burnt clay and additives) and mud blocks and can also be classified as hollow or solid blocks and are bonded with binders, usually sand-cement mortar or lime. Concrete blocks used on site are of different sizes and shapes or design. The normal sizes used in our local market are of the sizes 450mm x 225mm x 150mm or 450mm x 225mm x 125mm or 450mm x 225mm x 100mm. The size of the blocks is normally determined by the width, since the other dimensions are the same. Blocks can be made either in solid and hollow rectangular types (for normal wall) or decorative and perforated in different designs, patterns, shapes, sizes and types (for screen wall or sun breakers).

Steel reinforcing material: Reinforcement (i.e., deformed bars) is provided to control the extent and width of cracks at operating temperatures, resist tensile stresses and computed compressive stresses for elastic design, and provided structural reinforcement where required by limit condition design procedures (Naus 2005). Steel normally used on site are the ferrous metal and non-ferrous metal. Steel used on site can either be of the steel rod, steel plate or a structural steel. The materials can be mild steel or high yield steel. Mild steel is the most common and fairly light used as reinforcements in concrete and it is good in tension and compression but it is easily corroded due to external effect. High yield steel is an axially twisted steel bar used to produce cold drain deformed bars with improved bond to concrete and it is used as reinforcement for heavily loaded concrete elements.

Aggregates: Aggregates are inert granular materials and the most widely used material on site, it forms about 60% - 75% of concrete and can be of coarse aggregate (gravels or crushed stone) or fine aggregate (sand). Aggregate is used from the start of the project to the completion, this makes it a very important material in the construction industry. These are particles of hard and chemically inactive materials which when bond together by cement form what is known as concrete. Aggregate ensure the volume stability and durability of the resulting concrete and it is expected to be impermeable, clean, chemically inert, physically and chemically stable at high temperature and economical. Aggregates are classified in many ways as follows: (i) according to size -- into fine and coarse aggregates, (ii) source - natural and artificial aggregates, (iii) weight - lightweight and dense aggregate, (iv) particle shape - rounded, irregular, angular and flaky and (v) particle gradation - into well graded, poorly graded and gap graded.

Timber: Wood can be classified into hardwood or softwood and the former is of a higher quality and makes it more expensive. The very kind of wood that is suitable for building works is known as timber. Studies have shown that timber can be in the form of a round timber (log), sawn timber or board. Timber is a material, which can be used in any form. It possesses some specific qualities even when is not seasoned or treated, only that it will not last. Consequently, it is better seasoned. Seasoning of timber is the method whereby the rough timber is dried to bring the moisture content of the wood into the same range as that of the anticipated service conditions i.e., about 15%. Good timber possesses the qualities; hard to resist deterioration, sufficient strength to resist heavy structural loads, enough toughness to resist shocks due to vibration, property of elasticity, should be very durable, easily workable, retain its shape during the process of seasoning, etc. (Suryakanta 2015).

2.3 Factors that affect the cost of building materials in Nigeria

A price increase in building materials is a common trend in both developed and developing countries (Danso and Obeng-Ahenkora 2018). The increasing cost has put the hope of becoming potential homeowners by Nigerians in limbo.

Knowledge of the key factors contributing to these trends is a step towards finding solutions to the problem.

According to Shittu et al. (2015), the panacea to the problem of housing in Nigeria is the persistent increase in the prices of building materials. He further stated that it is due to increase in prices of petroleum products that has resulted in variation and fluctuation of market prices of materials for construction projects. Similarly, Eregha et.al. (2015) found a high positive relationship between the prices of PMS (Premium Motor Spirit) and AGO (Automotive Gas Oil) and inflation in Nigeria. They concluded that rises in petroleum products prices, especially PMS and AGO, significantly impact inflation in Nigeria. The rising raw materials cost along with other factors such as oil, gas and energy are the key causes of increases in the prices of building materials such as cement, roofing membranes and water proofing (Prior 2011 and Iyengar 2011).

Some authors attributed the increase to exchange rate of Nigerian Naria (Oladiran 2015 and Winapo et al. 2017). Oladipo and Oni (2012 as cited by Danso and Obeng-Ahenkora 2018) established that inflation, exchange rate, import, interest rate, money supply and demand for money have a significant effect on the prices of building materials in Nigeria. Another study conducted in Nigeria by Amos et al. (2018) found that import duties and exchange rate of the Nigeria Naria have influence on the prices of materials in the market. Similarly, a study by Akanni et.al. (2014) concludes that the exchange rate of the Naira, cost of fuel and power supply, and changes in government policies and legislations were the three topmost factors responsible for the rising of building materials.

2.4 COVID-19 pandemic implications to building construction industry

The building construction industry plays an important and dynamic role in the process of sustainable economic growth and development of any nation due to its size and complexity. The housing construction industry is one of the most important industries that underpins the economic development of a nation (Ganiyu 2016). It is to be noted that up to one-sixth of the total amount allocated to construction projects by Nigeria governments takes the form of building as observed from past budget of the country. The construction industry, which mirrors the economy, has taken a huge blow from the global and drastic spread of COVID-19 that resulted in the frequent lockdowns clamped to check the spread of the COVID-19 pandemic. The COVID-19 has introduced new challenges such as distancing on job sites, travel restrictions for project engineers, site safety and security, labor shortages, supply chains, unanticipated and prolonged delays, reduced productivity and cost overruns (Naulleau and Swetchine as cited by Kushal and Lochana, 2021). The impact of the COVID-19 pandemic is very detrimental and a poor impact has been made on the labor market, supply of materials, company liquidity, project delivery, key cost components on construction projects, and so on (Soumi and Debasish, 2021). A study on the effects of pandemic on construction industry in the Uk by Abdussalam et.al, (2020) found that Covid-19 has significantly affected the construction industry hence resulting in many projects being stopped and others extending their deadline. A finding on a study on the impact of COVID-19 on the construction industry in Ghana: the case of some selected firms shows that the major impact includes: a decrease in work rate, delays in payments and an increase in the cost of materials arising from border closure. (Agyekum et al. 2021).

The building material price trends in 2021 are harder to anticipate than ever. If you're planning a construction project this 2022, or you're about to start one, it will likely cost you more than it would have a year ago due to the COVID-19 pandemic. No single factor drives construction pricing. Numerous economic forces have varying degrees of influence, and this makes predictions about pricing somewhat challenging. Further, there will be lot more uncertainty in the post-COVID-19 market of materials supply. Windapo and Cattell (2013) found out that on the key issue affecting the development of the construction industry in Nigeria that increase in costs of building materials was a significant factor affecting development of the construction industry. The construction material prices change so quickly that the initial budget figures become completely unrealistic. In addition, an upward review of contract sum leads to conflicts between contractors and clients, likely leading to cases of abandonment where investments are tied down, since such project will not be put to use at the expected time.

Many large construction projects are temporarily or permanently abandoned. According to Kabirifar et.al (2019), one common reason for abandoned projects is the unpredicted factors causing from the preliminary estimation of the cost of projects through the forecasting stage, the conflicts between the estimated and real construction costs make the project unworkable during the execution stage, such causes may oblige the developer to abandon the project. In addition, material related factors can also led to abandonment. The abandonment of infrastructure does become a threat and causes an

environmental nuisance, slowing down development. When a building property is abandoned, it makes no positive aesthetic values, pleasures and makes no positive contribution to a neighborhood instead become eyesore to the vicinity. Further, development project abandonment contributes to the effect of wasted resources and loss of tax revenue (Olusegun and Micheal, 2011). According to Ayodele and Alabi (as cited by Okafor et al.2018) the effect of abandonment includes disappointment of the populace, low living standard, wastage of resources, reduction in employment opportunities, decrease in tempo of construction activities, decrease in revenue accruing to government and difficulty in attracting foreign loans.

Construction firms in the Nigeria can breathe amid COVID-19 pandemic as the government has lead down many measures that they need to adhere to them to operate successfully in construction and engineering projects. On the measures by construction companies in contributing to the fight against the pandemic, findings indicated: educating the workforce on the virus, the provision of PPEs, regular and effective checks on entry and exit from the site (Agyekum, 2021). Artificial intelligent (AI-based) technologies, drones, robots, autonomous heavy equipment, connected equipment and tools, augmented reality (AR), virtual reality (VR), and 3-D printed buildings have now been employed as augmentation tool to humans. And the collaboration tools and platforms such as telematics, mobile apps, zooming, skype meetings has been the new mode of communication in construction industries (Kushal and Lochana 2021)

Prior to COVID-19 pandemic, the company worked in group of teams where larger fraction worked in physical locations with very few members working remotely, and big offices, buildings and other fixed assets were considered mandatory for industries to operate. The current pandemic, however, brought significant changes in the construction industries and the fixed assets considered a must before, no longer seems to be a necessity. Under this NEW NORM, most industries have gone 100% virtual. The teams are meeting virtually and most of the works are performed virtually without need of workers to be physically present. However, this transition has not been easier for all the construction industries. But what executives need to be doing now is thinking about how to create the context for change, how to get their teams to embrace change, and how to ensure change is not a once and for all phenomenon.

III. METHODOLOGY

The study adopted a secondary quantitative data analysis method approach. The detail of the research problem is to survey the cost trends of building materials in Nigeria and the number of covid-19 cases in Nigeria to examine whether there is any relationship between the two.
The construction materials considered in this study are as follows: Ordinary Portland cement, Sand Crete blocks (225mm and 150mm hollow block), High tensile reinforcement bar (25mm – 6mm), Earthwork (Laterite filling, hardcore filling) and fine & coarse aggregate (sharp sand filling and crushed stone).

Data was collected on the daily updates on COVID-19 infections, recoveries and fatalities by the Nigeria Centre for Disease Control (NCDC). The COVID-19 outbreak in Nigeria data was from the website of Nigerian Centre for disease control, it was represented in table 1.

Quarterly prices of the building construction materials were elicited from quarterly bulletin of the Nigerian institute of Quantity Surveyors Lagos chapter. This is because their source of data is reliable and covers the nation. The data collected was for a period of seven publications spanning from May 2020 to Nov 2021. The individual quarterly prices of cement, sandcrete blocks, high tensile reinforcement bars, earthwork and fine and coarse aggregates considered in the study were presented in Table 2.

Data collected for this research was analyzed with the aid of Statistical Package for Social Science (SPSS) version 22 software. In order to portray the results for better understanding, the data was presented in bar charts. Furthermore, the statistical tools used for the test of hypothesis was the Pearson Correlation Coefficient.
Degree of correlation:
Perfect: If the value is near ± 1, then it said to be a perfect correlation: as one variable increases, the other variable tends to also increase (if positive) or decrease (if negative).
High degree (strong): If the coefficient value lies between ± 0.50 and ± 1, then it is said to be a strong correlation.
Moderate degree: If the value lies between ± 0.30 and ± 0.49, then it is said to be a medium correlation.
Low degree (weak): When the value lies below + .29, then it is said to be a small correlation.
No correlation: When the value is zero.

Table.1. Situation Report of COVID-19 Outbreak in Nigeria

S/NO	Month	Date	Weeks	Weekly cases (persons)	Cumulative Cases for each month
1a	Feb, 2020	2-8	Week 1	-	
B		9-15	Week 2	-	
C		16-22	Week 3	-	
d		23-29	Week 4	1	**1**
2a	March, 2020	1-7	Week 1	-	
B		8-14	Week 2	1	
C		15-21	Week 3	28	
d		22-29	Week 4	81	**110**
3a	May,2020	3-9	Week 1	1,763	
B		10-16	Week 2	1,470	
C		17-23	Week 3	1,905	
d		24-31	Week 4	2,636	**7,774**
4a	August, 2020	2-8	Week 1	2,603	
B		9-15	Week 2	2,630	
C		16-22	Week 3	3,135	
d		23-29	Week 4	2,103	**10,471**
5a	Nov, 2020	2-8	Week 1	1,126	
B		9-15	Week 2	1,058	
C		16-22	Week 3	1,235	
d		23-31	Week 4	1,029	**4,448**
6a	Feb, 2021	1-7	Week 1	8,506	
B		8-14	Week 2	6,606	
C		15-21	Week 3	5,720	
d		22-28	Week 4	3,583	**24,415**
7a	May, 2021	3-9	Week 1	238	
B		10-16	Week 2	290	
c		17-23	Week 3	310	
d		23-29	Week 4	4,322	**17,030**
8a	Nov, 2021	1-7	Week 1	752	
B		8-14	Week 2	434	
C		15-21	Week 3	442	
d		22-28	Week 4	503	**2,131**

Source: Adapted from Nigerian Centre for disease control (NCDC) (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/ www.covid19.ncdc.gov.ng

Table.2. Quarterly prices of the construction materials

S/No	Group	Materials	Unit	May 2020 ₦.00	Aug 2020 ₦.00	Nov 2020 ₦.00	Feb 2021 ₦.00	May 2021 ₦.00	Aug 2021 ₦.00	Nov 2021 ₦.00
1	Cement	Ordinary Portland Cement	50kg/ Bag	2,600	2,600	3,500	2,800-3,300	4,200	3,800	3,800
2	Sand Crete Blocks	25mm (9") Hollow Block	No	230-250	230-250	240-255	240	290	300	300
		150mm(6") Hollow Block	No	200-230	200-230	220-235	220	240	280	280
		100mm(4") Solid Block	No	170-190	170-190	195.50-205	195.5	195.5	240	240
3	High tensile reinforcement bar	25mm dia. (21pc)	Tonne	265,000	265,000	280,000	300,000	420,000	410,000	410,000
		20mm dia. (33 pc)	Tonne	262,000	262,000	275,000	300,000	380,000	410,000	410,000
		16mm dia.(52 pc)	Tonne	230,000	230,000	260,000	300,000	380,000	410,000	410,000
		12mm dia. (93 pc)	Tonne	230,000	230,000	260,000	300,000	380,000	410,000	410,000
		10mm dia. (133 pc)	Tonne	230,000	230,000	270,000	300,000	380,000	410,000	410,000
		8 mm dia. (.210 pc)	Tonne	225,000	225000	275000	300,000	380,000	410000	410,000
		6- 12mm dia mild steel reinforcement	Tonne	290,000	290,000	330,000	320,000	330,000	400,000	400,000
4	Earthwork	Laterite Filling (20 tons/trip	20 tons/trip	48,000	48,000	56,000	56,000	56,000	56,000	50,000
		Hardcore Filling (20 tons/trip)	20 tons/trip	25,000	25,000	30,000	30,000	30,000	30,000	30,000
5	Fine & Coarse Aggregate	Sharp sand Filling (20 tons/trip)	20 tons/trip	45,000	45,000	65,000	80,000	70,000	70,000	70,000
		Crushed stone (30 tons/trip)	30 tons/trip	150,000	150,000	175,000	200,000	175,000	175,000	175,000

Source: Adapted from Quarterly bulletin of the Nigerian Institute of Quantity Surveyors Lagos chapter (May 2020-Nov 2021).

IV. Data Analysis, Results And Discussion

4.1 Results and Analysis

To examine the trend of COVID-19 increase in Nigeria.

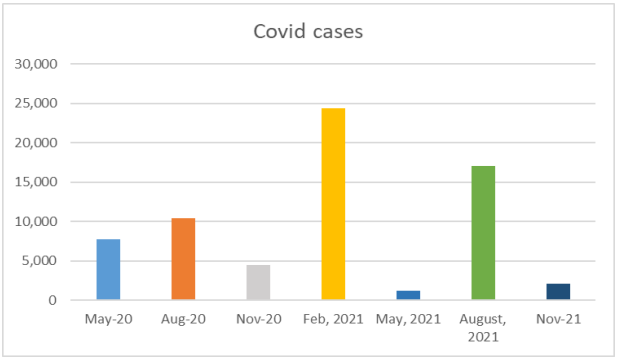

Fig.1. The trend of the COVID-19 cases

From figure 1, it was observed that there was a steady increase in the cases from May 2020 to August 2020, then a downward move in November 2020 and drastic upward move after. However, there was also a tremendous decrease in May 2021 but increased again from August 2021 and finally a crash in November 2021. In summary the cases have been up and down and currently. It is very low.

4.2 To examine the trend of building construction material increase in Nigeria.

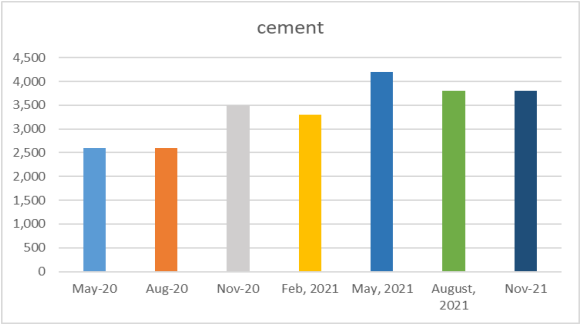

Fig.2. The cost trend of cement

From figure 2, it was observed that there was a steady price of cement between May to August 2020, but increased in November 2020, had a slight drop of trend in February 2021, increased again in May 2021 and finally dropped in price in August 2021 and had since been steady.

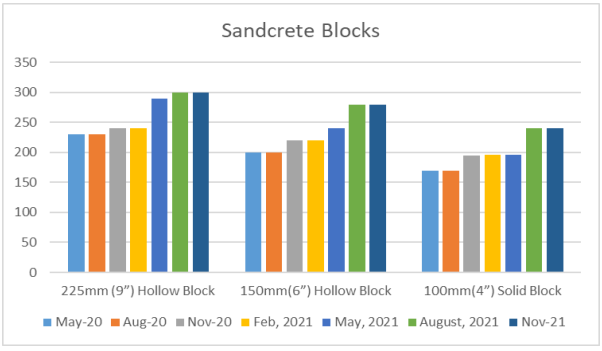

Fig.3. The cost trend of sand Crete blocks

From figure 3, it was obtained that the price of all the three (3) hollow blocks had similar trend sheet. Which in the first two quarters showed the same steady price (May & August 2020) and had a slight upward movement in the next two quarters (November 2020 & February 2021), though for 100mm solid block, it was same till May 2021. However, the prices had an upward price increase and has remained steady till Nov, 2021.

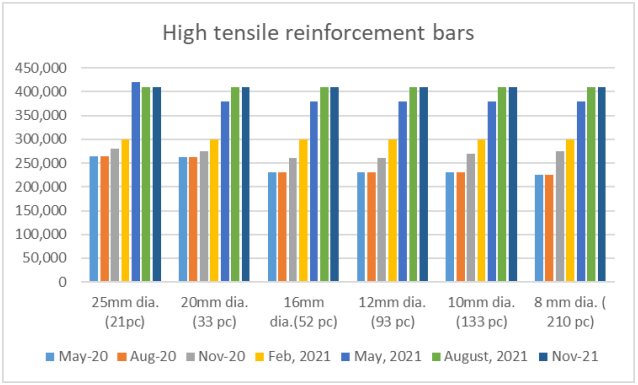

Fig.4. The cost trend of high tensile reinforcement bars

From figure 4, it was observed generally that the prices of high tensile reinforcement bars have not been steady though the patterns in trend were similar. In all the sizes the first two quarters (May & August, 2020) showed a constant price, afterwards there has been a continuous increase in their prices until August 2021 and has since remained steady except for 25mm diameter which showed a slight drop in price in August 2021 and has remained steady.

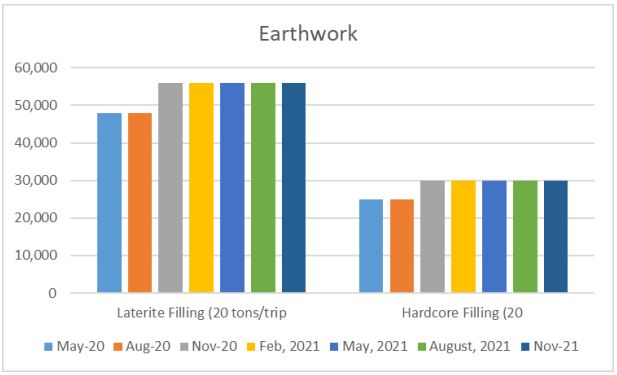

Fig.5. The cost trend of earthwork

From figure 5, it can be observed that the prices of both laterite and hardcore filling have a steady price between May to August 2020. They equally had an upward movement in price in November 2020 and had remained steady till Nov, 2021.

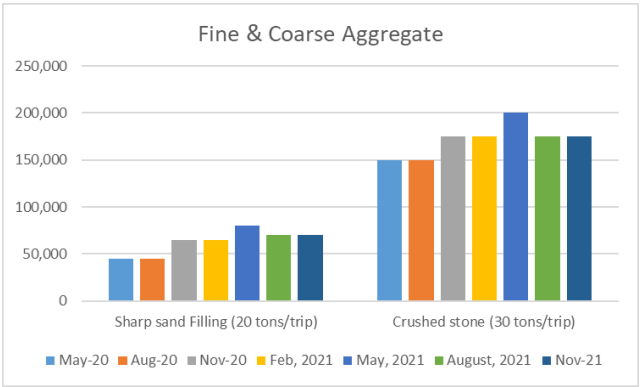

Fig.6. The cost trend of fine & coarse aggregate

From figure 6, it was observed that the price of fine & coarse aggregate was not stable. The prices have been upwards until August 2021 and had a slight price fall and the prices have been steady.

To identify the relationship between the no of cases of COVID-19 and the various cost of building construction materials.

Table.3. Correlations between COVID-19 pandemic outbreak and Ordinary Portland Cement

Ordinary Portland Cement	**COVID-19 pandemic**	**Remark**

Pearson correlation	0.726	Strong positive correlation, not significant
P-value	0.065	

Table.4. Correlations between COVID-19 pandemic outbreak and Sand Crete Blocks

Sand Crete Block	**Covid-19 pandemic**	**Remark**
25mm (9") Hollow	-0.292	Weak negative correlation, not significant
P-Value	0.132	
150mm (6") Hollow	-0.134	Weak negative correlation, not significant
P-Value	0.497	
100mm (4") Solid	-0.01	Weak negative correlation, not significant
P-Value	0.96	

Table.5. Correlations between COVID-19 pandemic outbreak and High tensile reinforcement bar

Reinforcement bar	**COVID-19 pandemic**	**Remark**
25mm dia. (21pc)	-0.222	Weak negative correlation, not significant
P-Value	0.256	
20mm dia. (33 pc	-0.139	Weak negative correlation, not significant
P-Value	0.48	
16mm dia.(52 pc)	-0.092	Weak negative correlation, not significant
P-Value	0.64	
12mm dia. (93 pc	-0.092	Weak negative correlation, not significant
P-Value	0.64	
10mm dia. (133 p	-0.105	Weak negative correlation, not significant
P-Value	0.593	
8 mm dia. (210	-0.108	Weak negative correlation, not significant
P-Value	0.583	
6- 12mm dia mild	-0.072	Weak negative correlation, not significant
P-Value	0.715	

Table.6. Correlations between COVID-19 pandemic outbreak and Earthwork

Earthwork	**COVID-19 pandemic**	**Remark**
Laterite Filling	0.248	Weak positive correlation, not significant
P-Value	0.204	

Hardcore Filling	0.039	Weak positive correlation, not significant
P-Value	0.843	

Table.7. Correlations between COVID-19 pandemic outbreak and Fine & Course aggregate

Fine & Course aggregate	**Covid-19 pandemic**	**Remark**
Sharp sand Filling	-0.149	Weak negative correlation, not significant
P-Value	0.449	
Crushed stone	-0.198	Weak negative correlation, not significant
P-Value	0.312	

Correlation Test for relationship between COVID-19 pandemic outbreak and cost of building materials were done using table 1 and 2

The results of correlation test between the Covid-19 pandemic outbreak and various cost of building materials were presented in Table 3, 4, 5, 6 and 7. The results indicated that covid-19 pandemic outbreak has a weak negative correlation with 25mm Sand Crete block $r = 0.671$, $p < 0.05$).

Correlations between COVID-19 pandemic outbreak variables are weakly, negatively correlated with 25mm Sand Crete Blocks. There was a non-significant, negative relationship between COVID-19 pandemic outbreak variables and Sand Crete block ($r = -0.292$, $p > 0.05$).

Correlations between COVID-19 pandemic outbreaks variables are weakly, negatively correlated with 150 mm Sand Crete Blocks. There was a non-significant, negative relationship between COVID-19 pandemic outbreak variables and Sand Crete block ($r = -0.134$, $p > 0.05$). Correlations between COVID-19 pandemic outbreak variables are weakly, negatively correlated with 100 mm Sand Crete Blocks. There was a non-significant, negative relationship between COVID-19 pandemic outbreak variables and Sand Crete block ($r = -0.010$, $p > 0.05$).

For Correlations between COVID-19 pandemic outbreak variables are weakly, negatively correlated with earthwork, Laterite filling and Hardcore filling both are not significant and positive relationship between Covid-19 pandemic outbreak variables and Sand Crete block ($r = -0.134$, $p > 0.05$). They are ($r = 0.248$, $p > 0.05$and $r = 0.204$, $p > 0.05$) respectively. While sharp sand filling and crushed stone both have weak negative relationship and are not significant ($r = -0.149$, $p > 0.05$ and $r = -0.198$, $p > 0.05$) respectively.

H_o- There is no significant relationship between the number of cases of COVID- 19 and the cost of construction materials.

The correlation is significant at the 0.05 level (1 – tailed) and based on the analysis above, all the P-values are more than 0.05. Hence, the null hypothesis is accepted therefore states that there is no significant relationship between the no of cases of COVID-19 and the cost of construction materials**.**

4.3 Research Implication

The results of the secondary data analysis discovered that there was general increase in the prices of building materials, the pattern for the cost of various building materials were similar which showed steady increase. This implies the increase in prices are independent of each other. The COVID-19 cases trend was not steady, the pattern had up and down movement. In addition, it was established that there is no significant relationship between the number of cases of COVID- 19 and the cost of various construction materials. This implies that COVID-19 is not responsible for increase in the cost of building materials in Nigeria. It is clear there are other factors that trigger fluctuation in the prices of building construction materials outside Covid-19 pandemic.

V. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The paper explored the effect of COVID-19 pandemic on the cost of building construction materials in Nigeria through a systematic literature review relevant to the study and secondary data survey. The data elicited from The daily updates on COVID-19 infections, by the Nigeria Centre for Disease Control (NCDC) and quarterly bulletin of the Nigerian institute of quantity surveyors Lagos chapter from a period of seven publications spanning from May 2020 to Nov 2021 were useful in the collection of secondary data.

Oladipo and Oni (2012 as cited by Danso and Obeng-Ahenkora, 2018) established that inflation, exchange rate, import, interest rate, money supply and demand for money have a significant effect on the prices of building materials in Nigeria. Another study conducted in Nigeria by Amos et al. (2018) found that import duties and exchange rate of the Nigeria Naria have influence on the prices of materials in the market. No single factor drives construction pricing. Numerous economic forces have varying degrees of influence, and this makes predictions about pricing somewhat challenging. The high cost of building materials poses a significant threat to both the building sector and people aspiring to own houses and as such, the need to provide lasting solutions, bring about steady building material prices, and avoid circumstances of constant price increases.

More recently, the pandemic has led to job losses and fewer construction projects going ahead because of the hard lockdown. Owing to the high level of concern that the COVID-19 pandemic has generated globally, a lot of studies have been carried out on the problem within the short time that the pandemic has lasted. Some of the studies examined the impact of COVID-19 on economic actitives (Teachout and Zipfel, 2020; Maryla et al. 2020). Others examined the impact on the construction industry both in country and outside the country (Alenezi 2020; Gamil et al. 2020; Zamani 2021, Anakan et al.2021). A study on the impact of COVID-19 on the construction industry in Ghana (Agyekum, et al. 2021), shows that the major impact includes: a decrease in work rate, delays in payments and an increase in the cost of materials arising from border closure.

5.2 Recommendations

Government should ensure a steady supply of power from the power sector as against the epileptic power supply, repair the local refineries, jettison the idea of removing subsidy on PMS for now and focus on deregulating the downstream sector to attract private investment, which in turn will encourage local refining of petroleum products instead of importing them. Hence, there will be a reduction of domestic prices for petroleum products and consequently inflation. These measures will indubitably, reduce the cost of production and transportation of construction materials.

Government should also regulate the prices of construction by creating policies that will tackle the inflation rate and exchange rate in the country. Production of local building materials should be encouraged in order to reduce importation of building materials. It is recommended that further research should be carried out to determine other control measures of increasing prices of building materials in Nigeria.

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