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Sustainable Construction Supply Chain Management in Southeastern Nigeria: A Case for E-Commerce

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ABSTRACT

Engineering and technology are two concepts that complement each other and are necessary ingredients for sustainability in a society either economic, social, etc. Growth in engineering and technology stimulates growth in other sectors of the society and one such sector is the telecommunication sector which gave rise to e-commerce technology. This e-commerce technology is very essential in our society, particularly in the construction industry. 105 respondents were sampled and administered questionnaires in the south-eastern states of Nigeria. The questionnaire contained perceived advantages of e-commerce and questions to ascertain if the respondents would accept the e-commerce technology and why and if they would use it to purchase especially construction materials identified from reviewed literature. With these, a relationship between willingness to purchase construction material using e-commerce and trust was established. Both descriptive and inferential statistics were used in analyzing the data. Results indicate that the e-commerce technology is welcome irrespective of some small bias and that convenience, provision of information, and reduction of fleecing of persons were some of the major reasons why they subscribed to the idea. Also, results show that purchasing construction materials through an e-commerce platform has huge potential. A significant positive relationship was found between willingness to purchase construction materials using e-commerce and trust in Nigeria. The study concludes by recommending important measures to be taken such as: Innovation and reforming of engineering education, enlightenment of the society on how to use e-commerce, upgrading research work and improvement of investment policies to create an attractive investment environment.

Keywords: Engineering, Technology, E-commerce, Construction, Sustainable development

INTRODUCTION

"Engineering" is not an abstract science, but rather is the efficient and economical application of scientific knowledge for the benefit of mankind. Engineering can be defined as follows: "Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically, the materials and forces of nature for benefit of mankind". In the aforementioned definition, the word "economically" is crucial. It denotes both the creation of economic utility and the best use of finite natural resources. The use of limited resources to satiate human needs and desires is the subject of economics, a social science. Since we live in a world with limited

resources, engineering must be closely related to the economy, which is the achievement of an objective at a low resource input cost. The adage "an engineer can do for one dollar what anyone else can do for two" may be appropriate to bring up here. Engineering is more than just doing projects; it's about doing them efficiently. Without a doubt, it can be said that, with a few notable exceptions, every engineering project is initially motivated by financial considerations, and that the financial viability of every engineering project ultimately determines its success. Unless it is the most cost-effective design among several alternatives, no engineering design can be considered valid. Therefore, it follows that economic feasibility is a crucial requirement for any successful engineering application. The historic four stages of economic development by [30] include:

- The poorest countries operate at the primary production-based economy stage, which is the first stage.
- The normal second stage is the growth of an industrial economy with low-quality, low-skill, low-paid jobs that frequently use out-of-date machinery that is unprofitable to operate and has an adverse environmental impact that is too great for more developed economies to continue using it. The occupational health and safety standards are the lowest at this stage, which has the potential to be very polluting. Since improving worker skill bases is required to exit this stage, many developing nations struggle to do so.
- The third stage typically involves a continuation of the growth of an industrial economy with the addition of resources for better tools and worker training as well as higher worker pay.
- The transition to a knowledge-based service economy is the fourth stage. Pay rates are high, cutting-edge technology is used, environmental impacts are beginning to lessen, and more expensive, better social services are available.

Engineering and technological innovation are necessary for sustainable economic development and industrial growth, but will society take the drastic measures needed to force radical technological innovation rather than the technological fixes that have been obvious to date? Such actions would incur long-term financial costs while the industry adjusts. It would seem that our society will continue to degrade unless sustainable change occurs, and the current generation may not be able to pass on an equivalent stock of environmental goods to the next generation if sustainable development is limited to minimal low-cost adjustments that do not require value changes, institutional changes, or any sort of radical cultural adjustment. Sustainable development cannot be achieved through minimal low-cost adjustments. [10] and [29], all highlight the need for transformative changes that go beyond minimal adjustments and emphasize the importance of value changes, institutional changes, and cultural adjustments in achieving sustainable development. The references underscore the potential consequences of failing to address these dimensions, emphasizing the risk of environmental degradation and the potential inability to pass on a sufficient stock of environmental goods to future generations. [31] were able to pinpoint the following elements important for technology adoption:

- Owner/manager's perspective, expertise, and assistance
- The employee's mindset, knowledge, and acceptance
- Resource availability
- Suppliers

- Customers
- Competitors
- Government
- Suppliers of technology products

[11] argue that "relative advantages, costs, organizational factors, technological factors, top management support, external pressures, and individual characteristics" are main factors influencing technology adoption in companies. According to them, "compatibility of the internet with organizational culture and infrastructure and top management support" are the most significant factors affecting internet adoption.

There are more than ten definitions for "sustain", the most common ones being "maintain," "support," and "endure." Sustainability is the capacity to be sustained, kept up, or continued. A sustainable system is one that uses methods that enable ongoing reuse to maintain its own viability. A sustainable development is one that can be maintained at a steady state level without seriously harming the environment or depleting natural resources. The ability to endure is one definition of sustainability.

For people, sustainability is the long-term upkeep of responsibility, which includes the idea of stewardship, the responsible management of resource use, and has environmental, economic, and social dimensions. Sustainability in ecology refers to how biological systems maintain their diversity and productivity over time, which is a requirement for human and other organisms' welfare. Wetlands and forests that live a long time and are in good health are examples of sustainable biological systems. Although "sustainable development" (SD) and "sustainability" are frequently used interchangeably to refer to a cause-and-effect relationship, neither of these terms has a single, accepted definition, [7], [2], [38]. These references explore the relationship between social and ecological systems, the role of ecosystem services in sustaining well-being, and the concept of sustainable development. They reinforce the idea that sustainability encompasses multiple dimensions and requires responsible resource management to maintain the long-term well-being of humans and ecological systems. They also highlight the evolving nature of the terms "sustainable development" and "sustainability" and the need for ongoing discussions and consensus-building around their meanings.

A more comprehensive definition of sustainable development (SD) considers "human", "environmental" and "economic" aspects and their interactions. SD can be defined as "solution to a problem which minimizes negative effects and considers the environment, people and economy". Sustainability = Economy + Ecology + Society. It means a productive economy, a healthy ecology and a just society (social equity) for present and future generations. Within this context, the term "sustainable engineering" has a variety of meanings [9]. For example, Dowling's definition of sustainable engineering includes a clear eco-efficiency focus: "Practices that promote environmental, social and economic sustainability through greater resource efficiency, reduced pollution and consideration of the wider social impacts of new technologies, processes and practices" [14]. Sustainable engineering literature often includes commentary regarding the importance of technological eco-efficiency particularly in the short term, accompanied by larger-term cultural and behavioral change.

With some of the more notable opportunities emerging over the last ten years in the power and communications industries, there has been tremendous growth in recent years. With more than 125 million subscribers, the telecommunications sector has paved the way for e-commerce in the nation. The majority of these subscribers access data via their mobile phones. [3] stated that electronic commerce could be simply defined as conducting business electronically, typically over the Internet. Electronic commerce is defined differently depending on the viewpoint that is in vogue. Electronic commerce is the electronic delivery of goods and information from a communications perspective. Electronic commerce, however, is the mechanisation of business workflows and transactions from the perspective of business processes [3]. According to [25], electronic commerce is a contemporary business strategy that addresses the needs of businesses, suppliers, retailers, wholesalers, and consumers to cut costs while enhancing the quality of goods and services and speeding up service deliveryAdditionally, the Organisation for Economic Cooperation and Development (OECD) defined electronic commerce as "the electronic trade of information that assists and oversees commercial activities" in 1999. These commercial activities included organisational management, commercial management, commercial negotiations and contracts, legal and regulatory frameworks, financial settlement arrangements, and taxation.

E-commerce has emerged as a promising tool for sustainable construction engineering, particularly in South-Eastern Nigeria. This region presents a unique context where the integration of e-commerce platforms holds significant potential for driving efficiency, cost savings, and environmental sustainability within the construction industry. The findings from [4] study on the prospects of e-commerce implementation in Nigeria provide valuable insights that can be applied to the South-Eastern Nigerian context. The research highlights the substantial benefits of e-commerce, such as improved market access, enhanced customer convenience, and reduced operational costs. However, the study also identifies critical challenges, including infrastructure limitations, trust and security concerns, and the need for improved payment systems and logistics networks. To effectively harness the advantages of e-commerce in sustainable construction engineering, it is imperative to address these challenges through strategic interventions, collaborative efforts, and targeted policy frameworks. Moreover, raising awareness among construction industry stakeholders about the benefits and safety measures associated with e-commerce is crucial for promoting its adoption and fostering sustainable practices. By incorporating the lessons learned from the Nigerian context, South-Eastern Nigeria can leverage e-commerce to drive sustainable development, streamline construction processes, and contribute to the region's economic and environmental well-being. E-marketing, E-selling, E-procurement of goods and services, E-collaboration, E-finance, and E-customer services and relations are some of the potential applications of e-commerce technologies in the construction industry [36]. The current market has all the necessary technological solutions for e-supply chain systems. A few of the key concerns for successful e-commerce in the construction industry have already been addressed, including signature exchange [8], secure payment [6], and fair contracting models [34]. Several people are involved in a construction project, including the client, the architect, the structural engineer, the fabricator, and the contractor. It is a collaborative effort with multiple, cross-organizational interactions. E-commerce refers to the use of any electronic channel for trading transactions,

not just trading over the internet. Electronic Data Interchange, EDI, which was created 20 years ago, may be under construction for a variety of reasons, such as:

- Communication is point-to-point, which makes it challenging to work within.
- Joint construction initiatives.
- The construction industry's high initial investment.
- Its hub-and-spoke design (which is not particularly advantageous to most)
- Construction firms (aside from those with a sizable supply chain)
- Standards must be agreed upon in order to send documents that are organised and formatted.

The old EDI, which operated on virtual private networks, can now be converted to the internet, making its use more cost-effective. The existence of open HTML and XML standards helps to further reduce some of the obstacles to using EDI. The nature of the construction industry tends to favour E-commerce, regardless of the use of EDI, the internet, or any other channel. The construction industry could benefit from increased use of E-commerce tools like EDI, email, electronic image processing, and CAD data exchange, according to research [22]. Additionally, some of these tools are already in use by the sector. E-commerce has the potential to provide enormous benefits. Since everyone can access bills of quantities, the quantity surveyor will need to be more fully integrated into the group and the project's scope. Conflict should be less likely if structural and architectural designers can communicate directly with trade contractors (and vice versa). If nothing else, less paper will be used, and the jobs that involve moving it will all be more lucrative. According to current estimates, cost savings from online trading will increase margins in the USA by 1%. Additionally, [12] lists the benefits of E-commerce as suggested by the construction industry:

- Greater transactional speed
- Lower Costs
- Information that is more recent
- Reduced paperwork
- Expanded Market
- Additional Information

The initial setup costs, loss of personal contact, the need to retrain staff, security concerns, and increased internal costs were also mentioned by organisations as drawbacks of e-commerce. The research survey also reveals that the industry's culture, implementation costs, security, a shortage of appropriately trained staff, legal concerns, and phone costs are all viewed as major barriers to e-commerce in the sector.

Currently, the majority of sizable construction companies keep websites up to date, though they primarily serve as sources of contact and information as well as advertising. Some of the websites also offer hiring tools. The development of construction-specific electronic markets is currently one of the key initiatives. Companies from both inside and outside the sector are vying for a piece of this lucrative market. Internet businesses outside the sector are aware of the enormous market potential in the construction industry. In the last few years, 150 to 200 internet-based businesses with a focus on architecture and construction have been founded in

the USA [21]; [20]. These companies' applications could have a significant impact on how construction companies conduct business, including how they plan, construct, and manage projects. In addition to eliminating the conventional jobs and positions, they will create new ones. The opportunity to significantly streamline design and construction operations is provided by the resulting online collaboration and E-commerce services. A successful model would be one that recognises the difficulty of the process, streamlines it, considers the needs of minor players, refrains from offering a quick fix, and takes the long-term effects into account. There is more to e-commerce than online trading. E-commerce is a new method of conducting business that affects organisational structures, transforms established industries, and creates brand-new market conditions, [13], [17]. These references highlight the growing influence of e-commerce and digital technologies in the construction industry. They emphasize the potential of online collaboration platforms and construction electronic marketplaces to streamline processes, introduce new ways of working, reshape industry structures, and have long-term implications for the sector. A construction supply chain is an active supply chain where the customers' needs and requirements are unceasingly changing, as in military logistics [33] and information technology is needed to make information visible in real-time as they occur [24].

A platform for the coordination of this kind of information is provided by the Internet. The Internet has developed as a tool for electronic commerce in recent years. The number of services that offer a platform for transactions and trading communities has increased. The rise in business-to-business transactions that is currently trending has sparked the creation of virtual marketplaces. The construction industry faces a challenge in creating Web communities for pooled construction procurement and disseminating information to all participants in the construction supply chain network now that the infrastructure for collective Internet procurement is in place.

Barriers to Electronic Commerce

Despite all the advantages that electronic commerce offers, there are some significant issues that need to be resolved in order to boost public confidence in the adoption of these applications. The obstacles to electronic commerce can be divided into two groups: those that apply to all industry sectors, including the construction industry, and those that are particular to applications of electronic commerce in the construction industry.

General barriers to electronic commerce can be categorized into three main areas: infrastructure, trust and reliability, and regulatory issues [22]. In terms of infrastructure, the telecommunications systems in many developing countries are not sufficiently developed to effectively handle the advancements in electronic commerce technologies, putting them at a disadvantage compared to developed countries. Trust and reliability are crucial aspects of electronic commerce, as data confidentiality, authentication of parties involved, and ensuring data integrity are essential. Furthermore, regulatory issues such as tax, legal, and ethical concerns create uncertainty for companies and hinder the adoption of electronic commerce measures.

In the construction industry, there are specific challenges in successfully implementing electronic commerce. These challenges include the tendency to remain in the business-to-business (B2B) mode, a lack of trust among participants in the supply chain, information lag, inadequate technical knowledge, and a shortage of skilled personnel.

To address these problems, several countermeasures can be taken. First, it is necessary to change the traditional mentality and foster a mutual trust mechanism to encourage cooperation among participants in the supply chain. This can be achieved by establishing specialized organizations and developing industry standards. Additionally, efforts should be made to promote the development of skilled personnel and increase enthusiasm among supply chain participants to embrace electronic commerce practices. These measures aim to overcome the barriers and enhance the successful implementation of electronic commerce in the construction industry.

The adoption of electronic commerce in the construction industry has been hampered by a number of factors, including the high initial investment required to build the necessary infrastructure and train personnel, the difficulty of calculating return on investment (ROI), the security of customer data during online transactions, the need for integration with legacy systems, and the lack of interoperability of distributed software applications over the Internet [35]. Additionally, "arm's length contractual relationships" are used in the construction sector, which discourages unneeded risk [40]. Teams are typically formed for the duration of construction projects, and these teams are only in place for the duration of the project. Relationships are transient, so there is little incentive to invest in cutting-edge technologies like electronic commerce. The investment justification for construction companies, particularly SMEs, is a significant barrier to the adoption of electronic commerce in the sector. According to [15], SMEs simply lack the funding necessary to put electronic commerce technologies into place to support their business and project activities. The reason is that investments in these technologies may not pay off within a year. As a result, the money used for initial setup is a dead investment during this time. Most SMEs can't afford to keep up with this investment.

If the infrastructure for using electronic commerce is properly created, the obstacles to its effective use can be removed. Firewalls and safe encryption methods can be used to address security issues. The majority of communication currently occurs via email exchanges, both within and outside of construction organisations. Since most e-mails are sent over public telephone networks between Internet service providers, they are neither more nor less secure than regular phone calls [3].

While examining the stages of economic advancement and the shift towards a service-based economy driven by knowledge, some insight into the subject of engineering and its relationship to the economy was provided, highlighting the significance of economic viability in engineering endeavours and the imperative of optimising resource allocation. Engineering techniques and the use of technical advances are crucial for achieving sustained economic growth and industrial expansion. The incorporation of technology into many industries, including the construction sector, as well as the possible benefits and challenges connected with the adoption of electronic commerce (e-commerce) within the construction domain were also looked at [26].

By understanding the interplay between engineering and the economy, it becomes clear that efficient resource utilization, technological advancements, and the embrace of e-commerce are crucial for driving economic growth and ensuring the success of engineering endeavors in a rapidly evolving world. Some of the questions to be answered include

- How can engineering projects be designed to achieve maximum economic efficiency while considering limited natural resources?
- What are the key factors influencing the adoption of technology, particularly e-commerce, in the construction industry?
- What are the potential benefits and challenges of implementing electronic commerce in the construction industry, and how can these challenges be addressed to facilitate its successful adoption?

METHODOLOGY

The study is aimed at finding out how construction industry stakeholders (clients and contractors/engineers) perceive the use of e-commerce (online store) as a sustainable engineering and technology tool for sustainable economic and industrial growth. To achieve this, the study used descriptive survey design, where elements and the variables that were studied were simply being observed without making any attempt to control or manipulate them. The research adopted questionnaire as the instrument of data collection. The study was conducted among the five South Eastern states. A total of 150 questionnaires were distributed to participants in the study, but the number thinned down to 105 after the questionnaires were checked for completeness and omissions, including errors of multiple answers. Non-probability sampling method was adopted in data collection due to the nature of the study. Purposive sampling method was adopted because it enabled us to administer the questionnaire to only respondents who are knowledgeable about the theme of the study and who are also willing. All the respondents were considered homogenous and this allowed for generalization. The study used the data collection instruments from two main sources which were the primary and secondary sources of data collection.

Processing and analyzing of the raw data were done using Statistical Package for the Social Science (SPSS) software. This was used to generate inferential and descriptive statistics such as the mean, composite mean, chi-square, standard deviation and frequencies from the respondents' responses to establish the relative importance and weight of each variable as well as the significance of the results. MS excel spread sheet tools were also utilized in illustrating the quantitative data. Regression analysis was used to establish the extent to which some independent variables explain some other selected dependent variables. The model is depicted as follows:

The general linear regression model is given by

$$\boldsymbol{y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots \beta_i x_i + \epsilon} \qquad \textbf{(1)}$$

As the outcome of logistic regression is binary, y was transformed using the logit so that the regression process can be used.

The study used quantitative method to analyze the data and examine the simultaneous effects of the independent variables on a dependent variable like trust, which accessed to what extent the respondents used, use and are willing to use an online store to purchase products. The study looked at variables in relation to the willingness of individuals to adopt e-commerce while other independent variables were some of the socio-demographic questions.

RESULTS

Table i: Demographic profile of research participants

Descriptor	Participant	Percentages
Status	Client	48.6
	Engineer/Contractor	51.4
Years of experience	<5 years	20
	5 – 10 Years	21.9
	11 – 15 years	4.8
	>15 years	4.8
	Not applicable	48.6
Projects involved in	1-3 projects	59
	4-6 projects	21.9
	7-9 projects	9.5
	>9 projects	9.5
Age Classification	20-30 years	17.1
	31-40 years	42.9
	41-50	21
	>50	19
Average cost of the project	$5-$20 thousand	61.9
	$21-$60 thousand	22.9
	$61-$80 thousand	7.6
	>$80 thousand	7.6
Highest Qualification	FSLC	10.5
	SSCE	8.6
	HND/OND	12.4
	B.Sc./B.Eng/B.Tech	32.4
	M.Sc./M. Eng/M. A	17.1
	Ph. D	19

A summary of the demographic information obtained from the survey respondents is given in Table i. A look at the results shows that the client respondents are 48.6% while the engineer /contractor respondents are 51.4%. This implies that there is almost an even distribution of clients and engineers/contractors. The results indicate that 20.0% of the respondents who are engineers/contractors have experience of less than 5 years while 21.9% of engineers/contractors have experience of 5-10 years. Engineers/contractors with 11-15 and 15 and above years of experience make up 4.8% each while 48.6% of the respondent who are clients did not respond to this question. The result indicates that 59.0% of the respondents have been involved in 1-3 projects while 21.9% have been involved in 4-6 projects. 9.5% of each of

the respondents have been involved in 7-9 projects or greater than 9 projects. The result thereby indicates that the majority of the respondents have been involved in at least 3 projects in their capacities as clients or engineer/contractors.

The results reveal that 17.1% of the respondents are between the ages of 21-30 years whereas 42.9% of the respondents are between the ages of 31-40 years. Also, respondents between the ages of 41-50 years make up 21% of the population while 19.0% of the respondents are 50 years and above. The result shows that 61.9% of the respondents which is a large majority have been involved in projects worth $5-$20 thousand while 22% of the respondents have been in involved in projects worth $21-$60 thousand. 7.6% of the respondents have been involved in projects worth $61-$80 thousand and above $80 thousand respectively.

The results show that 10.5% of the respondents hold a First School Leaving Certificate (FSLC) as their highest educational certificate while 8.6% of the respondents hold a Senior Secondary Certificate 12.4% of the respondents are HND/OND degree holders whereas 32.4% have B.Sc. /B.Tech./B.Eng.17.1% have M.Sc./M.Eng., while 19% of the respondents are Ph.D. holders. This result indicates to a large extent that the population reviewed for the research could be called educated. [41] found that the level of education is positively correlated with an individual's internet literacy.

The respondents were asked how many times they have utilized an e-commerce platform to purchase a product in the last year. 41.0% said they have never used an online store to purchase a product in the last year while 59 % have used an online store to purchase a product in the last one year. Again, the respondents gave their responses to the number of times they have used the online store to at most check for information about a product or clarify price. 8.6% admitted they have never used an online store within the last year to get information of any sort about a product. 91.4% said they have used an e-commerce platform within the last year to search for information about a product. In order to test the respondents', resolve towards using an online store, they were asked if they thought using an e-commerce platform in addition to using the traditional shopping methods would be most desirable. 6.7% of the respondents disagreed with that school of thought while 93.3% agreed. 8.6% said they may never use the online store to either purchase a product or search for information about a product. 91.4% said they would be willing to use an e-commerce platform to purchase a product or search for information.

The respondents' answers to the question of whether the have ever made any purchase using an e-commerce platform, 58.1% of the respondents said that have purchased various items through an online store. These items ranged from electronic and electrical items, clothing, mechanical components, books, medicine and even construction materials like tiles. 41.9% of the respondents have never made any purchase using an e-commerce platform as shown in Figure i. Figure i shows the reactions of the respondents when asked if they would be willing to purchase construction materials online. 54.3% said they would be willing to purchase construction materials online while 45.7% said they would not be willing to purchase construction materials online.

Table ii: Perceived advantages of e-commerce

Perceived Advantages of E-commerce	Mean	Rank
Provide price information building materials	1.10	1st
Convenience	1.21	2nd
Offers and Discount	1.23	3rd
Reduce fleecing of clients abroad by relatives/friends and contractors	1.27	4th
Post sales follow-up from service provider	1.28	5th
Verified material supplier	1.29	6th
Transfer risk of damage of materials during transit or theft	1.29	6t
Genuine products and services	1.30	7th
Legal factors	1.32	8th
Consumer can trust detail provided by website	1.44	9th
Eliminate/reduce procurement of substandard material	1.47	10th
Eliminate risk of new site and location for engineer	1.67	11th
Eliminate new supplier issue associated with new site	1.67	11th
Composite mean	**1.35**	

Table ii shows the ranking of the perceived advantages of e-commerce and their composite mean score of 1.35 which inclines to the yes which has a weight of 1 and no a weight of 0. This means that the respondents fairly agree that these perceived advantages could be enjoyed on implementation of e-commerce. Provision of information, convenience, discount and offers ranked 1st to 3rd while elimination of risk of new site and location engineer and elimination of supplier issue associated with new site ranked just bottom.

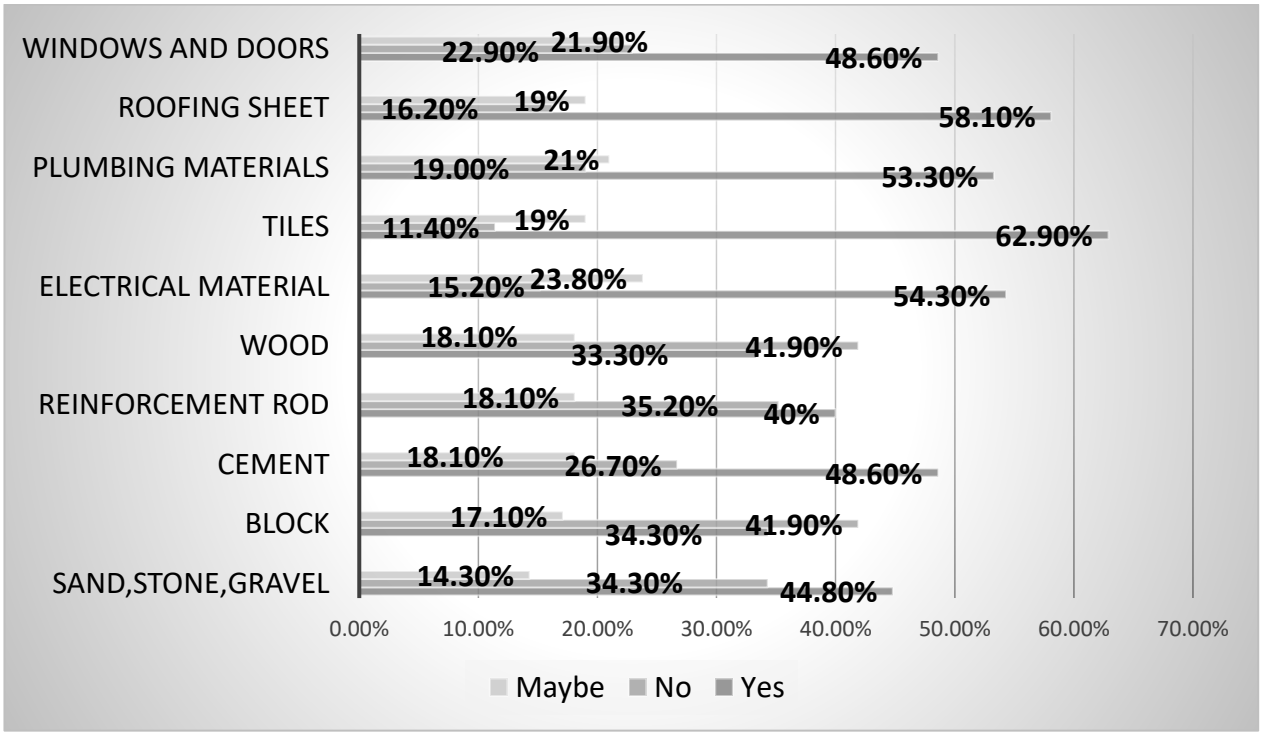


Figure i: "YES, NO, MAYBE" responses of respondents to construction items they could purchase using an e-commerce platform.

The outcome in Figure 1 gives the reaction toward the use of e-commerce platform to purchase building materials. Majority of the respondents are willing to purchase even though there is still a small population who are still on the fence and those who would not subscribe to the idea. The graph shows that tiles, electrical materials and reinforcement rods were the most materials bought while purchasing of blocks and wood using an e-commerce platform did not catch the respondent's fancy.

Table iii: Regression analysis done between independent variables trust and a dependent variable willingness to purchase construction materials using an e-commerce platform

MODEL	UNSTANDARDIZED COEFFICIENTS		STANDARDIZED COEFFICIENTS	
	B	STD. ERROR	BETA	SIGNIFICANCE
CONSTANT	-2.621	0.644	0.073	0.000
TRUST	1.841	0.465	6.303	0.000

Table iii shows results from the regression analysis;

$$\boldsymbol{Y = \alpha + \beta x_T + \epsilon} \qquad \textbf{(1)}$$

Where:

$\boldsymbol{Y}$ is willingness to purchase construction materials using e-commerce
$\boldsymbol{\alpha}$ is$\boldsymbol{Y}$ intercept when $\boldsymbol{x}$ is zero
$\boldsymbol{\beta}$ is regression weight to the variable
$\boldsymbol{x_T}$ is Trust
$\boldsymbol{\epsilon}$ is Stochastic error term

The coefficient of trust gives the magnitude of change in willingness to purchase construction materials using e-commerce due to change that occurred in trust which in this case is 1.841. This implies that a unit increase in trust results in about 1.841 units' increase in willingness to purchase construction materials using e-commerce and vice versa, while the intercept (constant) is -2.621. The estimated model is presented in Equation (2)

$$\boldsymbol{Y = -2.621 + 1.841 x_T} \qquad \textbf{(2)}$$

On this basis, it was concluded that a significant predictive impact of trust exists on willingness to purchase construction materials using e-commerce in Nigeria, such predictive impact is 1.841 units' increase (or reduction) in willingness to purchase construction materials using e-commerce for a unit increase (or decrease) in trust.

DISCUSSION

The study with respect to establishing the perception of industry stakeholders to the use of e-commerce within the industry found out that the population under review responded well to the idea of using online stores (e-commerce). This means that the use of e-commerce is generally accepted and can be chosen in line with [5] view that affirmative perceptions towards

ICT benefits provide an inducement to adopt ICT in business transactions. With the always-changing nature of technology, the respondents said that anything could be marketed and that the convenience and efficiency that come with a trustworthy e-commerce system, would really enhance the construction industry. [27] presented similar finding that indicate that perceptions regarding the benefits, costs and risks of using an e-commerce system would significantly affect its adoption. These inducements to adopt are fueled also by the majority of the respondents who were already willing to purchase construction materials online.

Like many respondents said, e-commerce generally is still in an incubation period in our society but its benefits when properly implemented as the respondents to have attested to with their response on the perceived advantages is awe-inspiring. From the findings, we would see that there is an adamant population who would not sway but over time with an unceasing awareness of the benefits of the system, judicious implementation of doubt-extinguishing incentives and absolutely effective communication between parties, they would come around. The Nigerian construction industry is still growing and lacks the maturity and creativity needed to gain a strong grip on the global Internet or e-commerce market [1].

[16], whose findings overwhelmingly support the findings of this research concerning issues facing e-commerce within the construction industry, suggested that the use of e-commerce would enhance the implementation of government policies, enhance environmental protection and trigger sustainable development. E-commerce innovation rests on two basic capabilities: technological and business. The two basic capabilities combine, along with routines of the construction industry to form the dynamic capabilities of the online store. The technological capabilities include planning IT infrastructure or developing the store, integrating software platform, designing content, and delivering new services. The business capabilities are envisioning the client's value, executing business innovation, matching with economic opportunities, and building relationships among parties involved. The importance of combining technological and business capabilities in creating innovative e-commerce solutions that drive growth cannot be underplayed. Drawing on the systematic review conducted by [18], it is evident that e-commerce has a positive impact on business model innovation. The review indicates that e-commerce enables businesses to innovate at a faster pace by granting access to new technologies and markets. Moreover, it helps reduce the cost of innovation by providing alternative ways to reach customers and collect valuable data. Additionally, e-commerce expands the reach of innovation by opening avenues to engage with customers in new markets. These findings underscore the potential of e-commerce as a powerful tool for fostering business innovation. By developing the necessary technological and business capabilities, businesses can leverage e-commerce to create novel business models that cater to customer needs and unlock new growth opportunities. [39] argued that information technology (IT) can play a key role in business model innovation. They define business model innovation as "the creation of new business models or the reconfiguration of existing business models." They argue that IT can help businesses to innovate in a number of ways, including by providing new ways to reach customers, new ways to create and deliver value, and new ways to capture value.

Governments and the professional support communities will continue to face difficulties in creating sustainable economic and industrial growth. Governments can maximise the potential

to deliver improved living standards for the people of the industry (construction), the nation, and the region as a whole by involving engineering and technology as a key player in the development of economic and industrial growth plans. Important steps must be taken to achieve these successes, including the modernization of engineering education, advancement of research, and enhancement of investment policies to foster a favourable investment climate. The dream of e-commerce is now a reality thanks to the internet's exponential growth in usage. Any business cannot afford to ignore the growing E-commerce market. Technology is improving quickly and offering online services in a timely manner. The statements that developing sustainable economic and industrial growth will continue to be a challenge for both governments and professional support communities are supported by the research of [1], [18], [23], [28], and others. Governments can maximise the potential to deliver higher living standards for the people working in the industry (construction), the nation, and the region as a whole by involving engineering and technology as key players in the development of economic and industrial growth plans. Important steps must be taken to achieve these successes, including improving engineering education through innovation and reform, upgrading research, and enhancing investment policies to foster a favourable investment environment. The dream of e-commerce is now a reality thanks to the internet's exponential growth in popularity. For any business, the growing e-commerce market is simply too large to ignore. Technology advances are advancing and delivering online services very quickly.

[32] explores the adoption of e-commerce in developing countries and its potential to bring significant improvements to people's lives. It acknowledges the benefits of e-commerce, such as access to new markets, products, and services, but also highlights the challenges hindering its widespread adoption. These challenges include the lack of necessary infrastructure, such as reliable internet access and secure payment systems, limited awareness among individuals, and concerns about trust and security. The authors propose solutions to overcome these challenges, including government initiatives to develop infrastructure and educational programs to raise awareness. They also stress the importance of businesses tailoring e-commerce solutions to meet the specific needs of consumers in developing countries. The article concludes by emphasizing that e-commerce has the potential to drive economic development in developing countries, but only if the current adoption challenges are successfully addressed.

CONCLUSION AND RECOMMENDATIONS

Adoption of e-commerce has effects on organisations and businesses as well. Business revolutionization is not a simple fix. Planning and strategies must be carefully considered. A varied and multifaceted approach is necessary to be successful in this novel and distinctive medium. The performance of the construction sector in online commerce is below that of other business sectors. To bring conventional construction processes online, a number of models and initiatives are surfacing, which is encouraging. External websites also recognise the enormous potential of construction E-commerce. System standardisation and consolidation are crucial steps in enabling effective models and real advancements. Only those business models that comprehend the intricate nature of the construction industry will succeed in making the most of E-commerce in the sector.

It would be suggested that engineering and technology professionals should encourage and enlighten the society on how use of e-commerce. Also, in order to get more narratives from respondents on how they feel about the use of e-commerce, future research should include other qualitative methods such as Focus-Group-Discussion (FGD) and In-Depth-Interview (IDI).

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