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Preamble

One of the most reputed mediums of exchanging the outcomes of research activities is the academic journal, and it is germane, as scholarship is about the creation and sharing of knowledge.

The reasons for the creation of the Construction and Human Settlements Management Journal (CHSMJ) include:

i. providing a unique record of scholarly activity in Construction and Human Settlements Management while presenting an African perspective to the academic community.

ii. scholarly recognition it brings to the Nelson Mandela University.

iii. creation and sharing of new ideas and knowledge which contributes to the economic and cultural development of the built environment in South Africa, Africa and beyond.

iv. it also supports the goals of Nelson Mandela University by giving national and international recognition, further demonstrating the ability of the university to compete with other research agencies in the production of knowledge while also forming a basis of new collaborations between local, regional, and international researchers, research departments, and institutions.

v. the publication helps close the "knowledge gap" between the developed nations and the often-overlooked ideas, innovations, and discoveries from the African continent.

vi. the enrichment of the research areas of construction and human settlements management, and

vii. the Journal does, through sharing local knowledge and perspectives, make local research more visible throughout Africa and to researchers, students, and scholars globally.

Topics

The Construction and Human Settlements Management Journal, although not limited to, covers the following topics:

Construction project management; Project management; Design and construction management processes; Housing and infrastructure development; Stakeholder management; Project planning and impact assessments; Design and implementation of labour-intensive projects; Procurement management; Management of construction companies; Industry development; Knowledge management in construction; Empowerment of women; Innovation; Human settlement development and management; Real estate development and management; Industry 4.0; Housing; Spatial planning; Project financing; Performance management in construction and projects; Human factors in construction and projects; Health, safety and well-being in construction and projects; Scholarship of Construction and Human Settlements; Current and emerging infrastructure issues in developing countries.

Access

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Editorial

Dear colleagues in the research community. We are delighted to present Volume 2 Issue 2 of the Construction and Human Settlements Management Journal.

In this issue, the first paper by Nani *et al* discusses the prevailing effects of funding challenges on public sector projects in the Ghanaian construction industry. They found that, as a result of funding challenges, projects are regularly abandoned, time and cost overruns abound, end users are unable to occupy building projects on time, government revenue from building tax is negatively impacted and there is difficulty in attracting foreign loans due to sub-optimal risk management. Nani *et al.* propose alternative project financing vehicles such as public-private financing.

The second paper by Muritala *et al.* investigated risk management strategies in real estate development in Lagos. They lament that despite the critical need for managing risks that cause project delays and cost overruns in real estate development in Nigeria, suboptimal research has been conducted on adopting managerial approaches to risk management in that industry. Their study recommends a total shift from the traditional approach to risk management in real estate development in that part of the world to managerial approaches.

The third paper, a contribution from Akure by Jayeoba et al deals with sub-optimal traffic movement in an artery in that area. They point out that there is major gridlock in the morning and afternoon peak hours caused by insufficient road carriage capacity with serious productivity loss for the morning shift. They recommend a number of interesting interventions to reduce the traffic congestion and improve route performance.

The fourth paper in this issue by Oladiran and Ameh looks at challenges and solutions to the adoption of building information modelling in Nigeria. Their contribution shows that BIM in Nigeria is still in infancy and there is much work to be done by all users to increase accessibility to hardware and software and improve communication on benefits that can accrue from utility of BIM. They recommend, among other interventions, active participation in BIM training by Architectural, Engineering and Construction professional bodies.

The papers are available for download or onsite access at https://sbe.mandela.ac.za/Construction-and-Human-Settlements-Management-Jour

With warmest regards,

Winston Shakantu and Ayo Adeniran

Editors

Prevailing effects of funding challenges on public sector projects in the Ghanaian construction industry

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Abstract

Taking into account the role of public projects in accelerating development is fundamental to the Ghanaian Construction Industry. A positive note is an increasingly growing trend of infrastructural projects within the public domain. Government and its institutions constitute a prodigious proportion in financing developmental projects. Undeniably, financing the physical, social and economic infrastructure has been a gigantic subject for several developing countries. Construction projects funded by the government are overwhelmed by many challenges and the effects are dire. Hence, the study identifies the effects of funding challenges on public sector projects in the GCI. The research philosophy adopted for this study was undergirded by positivism. The sampling technique adopted for this study was purposive sampling technique and was employed to reach out to project managers, construction managers, Quantity surveyor and other professionals with the requisite knowledge to help achieve the aim of the study. A research approach integrating a questionnaire survey in a quantitative research strategy was used. Subject to data analysis, Mean score ranking was used to rank the effects of funding challenges of public sector projects in the GCI and one sample t-test was conducted to establish the relative significance of these factors. Results from the study exposed, abandonment of projects, time overruns, cost overruns, inability to occupy building projects on time by the end-users, decrease in revenue accruing to government and difficulties in attracting foreign loans as the most perilous effects of funding challenges on public sector funded projects in GCI.

Keywords: Challenges, Infrastructure, Construction projects, Public funded projects, Project finance.

1. Introduction

In recent years, developing countries have made efforts to increase the rate of development (Morellec *et al*., 2013). The construction industry operations have significantly impacted socio-economic development by providing facilities that boost infrastructure and employment (Owusu-Sechere, 2008). The Ghanaian Construction Industry (GCI) is enormous, and it is one of the primary drivers of the nation's economy (Amoatey *et al*., 2015). A positive note is that there is an increasingly growing trend of projects in the public sector of Ghana (Amponsah, 2014). Globally, governments are charged with the responsibility of providing the physical infrastructural needs of their citizens (JETRO, 2010; AfDB, 2013; Watermeyer, 2013). This has brought about more significant demand for infrastructural facilities, like the construction of schools, health facilities, roads etc (Meng, 2004). As suggested by Ngowi *et al*. (2006), one of the critical indicators of a growing economy is the growth of its infrastructure base. Bhat

(2006) defined infrastructural projects to include the construction of roads, railways, airports, seaports and power generation plant. Milford (2010) stipulated that the inability of the public sector to finance the construction of projects results in the cumbrous and in most cases, the consequences are sometimes seen in delayed payment of the contractor. Hence, sources such as bank loans, grants, bilateral or multilateral agreements are used to raise funds to finance infrastructural projects is deemed necessary (Amoah *et al*., 2011; Badu *et al*., 2012; Morellec *et al*., 2013).

In Ghana, the government is the foremost client in the construction industry. With the merger of available resources in the country to satisfy all sectors of the economy, enough of the resources are not channelled to the infrastructure sector making it extremely difficult to meet the enormous demands of its infrastructural needs across the board (Osei, 2013; Kassaye, 2016). Traditionally, foreign borrowing by governments has served chiefly as a means of reducing the intensity of infrastructure funding problems (Ngowi *et al*., 2006). This has resulted in a slow rate of progress in the industry, basically due to its reliance on the government for funding all infrastructure projects in the country (Delloite, 2013; Addo, 2015). According to Ken Ofori-Atta, the Minister of Finance, the government requires thirty billion Ghana cedis to address the infrastructure deficit in the following sectors: health, transportation, water, sanitation and the power sector (Ghanaweb, 2018). Hence the government borrows more money to finance its infrastructural expenditure (Ngowi *et al*., 2006). These borrowed funds are expected to be geared towards cost estimates of infrastructural projects (Twumasi-Ampofo *et al*., 2012). As a result, project funding has become more critical for developing both public, private partnerships and privately funded infrastructure. The slow growth of infrastructure development in Ghana is a result of extra cost arising from projects expenditure and funding issues (Ngowi *et al*., 2006). Ghana is already grappling with how to pay for its growing debt load. To pay interest on debt, the government has been issuing bonds at high-interest rates, a trend that keeps the debt profile expanding at an alarming pace (Yusuf and Mohd, 2021). As a result of this trend, certain governments, most notably the Chinese government, have refused to accept loan applications submitted by the Government of Ghana (GoG) for public sector infrastructure finance (Foster and Briceño-Garmendia, 2010; Dadzie *et al*., 2012a). Despite the massive investment in Ghana's infrastructure for the past two decades, most of the infrastructure projects in Ghana are incomplete. However, enormous amounts have already been invested in these projects (Addo, 2015).

Several studies have been conducted in Ghana within the public sector on construction projects (Liu and Chern, 2008; Dala *et al*., 2010; Ampadu-Asiamah and Ampadu-Asiamah, 2013; Ameyaw *et al*., 2014; Amoatey *et al*., 2014; Asiedu and Alfen, 2016; Marteye *et al*., 2018; Owusu-Manu *et al*., 2019a; Kissi *et al*., 2019), but have failed to highlight on the effects of funding challenges of public sector projects. Researchers and policymakers have repetitively asked the question of the challenges facing infrastructure finance due to its potential for economic growth (Ehlers, 2014). Past studies have dedicated much attention to investigating projects development and the repercussion of inadequate funding of public projects broadly in Ghana. Nonetheless, a brief look at the effects

of funding challenges on public sector projects, especially in Ghana, is missing in current and growing literature (Marteye *et al.* (2018). This study seeks to fill this gap and also reveals to policy makers the effects of not funding the completion of public sector projects in Ghana. This study is focused on ascertaining the overall effects of funding challenges of public sector funded projects in the GCI. Simultaneously, this seeks to provide directions to policymakers and construction stakeholders on mitigating the snags of public-funded projects in the GCI at large. The findings of this study contribute progressively to the discussion on the debate intertwined with public-funded construction projects among academia.

2. Financing public sector projects: An overview

Mandisa (2015) believes that construction projects have no static classification. In most cases, the term "construction project" is used to describe the construction of structures, such as buildings, transportation, sewers and railways (Durdyev and Ismail, 2012; Owoo et al., 2018). However, various types of construction projects have quite different characteristics in terms of planning, method of procuring professional services, how contracts are awarded and financed (Elbeltagi, 2009). Foster and Briceño-Garmendia (2010) and Safa et al. (2015) acknowledged that construction projects could be classified as residential, institutional, and commercial building, specialized industrial construction and infrastructure construction. Moreover, extensive planning is vital for a project to be executed successfully. Financial resources are, however, needed for the construction of public projects. As a result, strengthening access to financing for construction projects would enable contractors to choose the kinds of projects they want to participate in (Ofori-Kuragu, 2013).

Project financing has emerged as a vital way to fund large-scale, high-risk local and international development projects (Gatti, 2013). The phrase project financing pertains to the funding of projects based on project cash flow repayments, as established by legal arrangements within each project (Khmel and Zhao, 2016). Project financing has risen tremendously in the last several years. Gatti (2013) alluded that the world economy is presently growing at its quickest pace ever, which is why project finance has arisen so brilliantly recently. There is no doubt that building adequate infrastructure is essential for long-term economic prosperity (Tule *et al*., 2015).

According to Amnoya (2008) and Babatunde and Perera (2017), there are three ways to finance infrastructure projects. These methods are classified as private public-private partnerships and public financing. Meanwhile, Build-own-operate-transfer, build-transfer lease-operate, and build-operate-transfer are all examples of private sector engagement (Foster and Briceo-Garmendia, 2010). Public-Private Partnership (PPP) application is a potential strategy for obtaining private financing (Khmel and Zhao, 2016).

Financing of infrastructural projects by the private sector in Africa was necessitated by the failure of African countries in the 1980s to resolve the financial crisis at the time (Murugan, 2013). Conferring to a history of public funding of infrastructure projects, private investors (Foster and Briceño-Garmendia, 2010) financed infrastructural projects in developed countries before the twentieth century.

They identified that public financing of infrastructural projects came about due to the significant wars which weakened their economies (Foster and Briceño-Garmendia, 2010). The current system of road infrastructure financing in developing countries can be traced to the nature of colonial rule (Meenaksh, 2008). Ehlers *et al.* (2014) explained that colonial masters (British) developed only those facilities that made it easier to exploit natural resources. At the end of colonization, the new governments inherited economies with virtually no private sector (Ngowi *et al*., 2006). The government, therefore, had to finance infrastructure projects by itself, and this has been the case since then (Ngowi *et al*., 2006).

Moreover, Governments usually have a much broader and more direct role in project financing than in any other form of private funding (Gatti, 2013). The government is recognized as the sole financier of infrastructural projects, based on the view that a developmental task is a public good (Amnoya, 2008). A partnership between the state and private investors represents a category of financing. Here the private investor is given equity in the project (Ehlers *et al.,* 2014). The unique feature here is that the risk of the project is shared by both the state and the private investor based on the proportion of equity (Foster and Briceño-Garmendia, 2010).

The above discourse: an infrastructure gap, stumbling blocks in obtaining private financing and the inability to raise additional revenue through increased taxation, as well as the focus on profitability of the private sector, all point to a need for innovative methods to address financial issues (Banda *et al*., 2009; Banda and Haang'andu, 2009; Banda *et al*., 2009). Some growing economies are held back by a lack of well-functioning infrastructure (Ehlers *et al.,* 2014). Since private sector participation boosts project implementation and funding, the public sector's critical function is to provide the right environment for such benefits to be realized (Amnoya, 2008). A sound legal system is essential, in addition to a proper contractual arrangement as developmental project investments are long-term, and government uncertainties need to be factored in (Twumasi-Ampofo *et al.,* 2012).

Notably, to meet the increasing need for project spending, new sources and finance instruments are needed (Ehlers et al., 2014). Banks are now shouldering the lion's share of the increase in infrastructure finance (Twumasi-Ampofo *et al*., 2012). Banks will continue to play a huge role in financing new projects, especially in the early stages (Amnoya, 2008). As a result, a much larger group of investors must be targeted. Further, Banda and Haang'andu (2009) and Owusu-Manu *et al.* (2019b) specified that bonds are an appropriate tool for major institutional investors with long-term liabilities, such as mutual funds and insurance firms. Twumasi-Ampofo *et al.* (2012) acknowledged that development banks and export credit agencies have an essential role in financing infrastructure, and would help benefit developing and industrialized nations as a result of the careful use of financial instruments such as guarantees and mezzanine cash. Infrastructure investment funds, for example, may assist in tapping into the immense resources of the international financial markets as an additional alternative to traditional sources of financing (Banda and Haang'andu, 2009). A more comprehensive mix of financial instruments would make for greater risk diversification amid a larger community of investors (Amnoya, 2008).

Traditionally, a public-funded project is classified as a public good, that is individuals within the country have equal access and use of the facility (Amnoya, 2008). Ghana's public sector projects are financed from three primary sources (Ngowi *et al*., 2006). They are discussed below.

One of the sources of funding is donor funds. These are funds provided by international organizations and development partners (Amnoya, 2008). They are used mainly to develop new roads and for maintenance works. This forms the most significant funding for buildings and roads, contributing over 50% (Amnoya, 2008).

The GoG established the Ghana Road Fund (GRF) to enhance the country's road conditions. Its primary objective was to increase funding for road maintenance and quality enhancement. In 1997, the GRF was restructured to improve its effectiveness and efficiency, resulting in the RF Act 1997, (Act 536) (University of Cape coast, 2017; Directorate of Research, Innovation, and Consultancy, 2017). The RF is fully supported via transportation-related income sources like road tolls, fuel taxes, and car registration fees (Foster and Briceo-Garmendia, 2010). An independent organization manages the fund (Satish, 2006). This provides around 30% of road construction funding and 60% of road maintenance funding (Ministry of Roads and Highways, 2014; Institute of Fiscal Studies: IFS, 2016). According to the University of Cape Coast's Directorate of Research, Innovation, and Consultancy (2017), the RF's scope has been broadened to encompass road upgrades and rehabilitation, road safety activities, selected road safety projects, and other related topics chosen by the board. However, according to IFS (2016), income into the RF has fallen short of projections. This is because it is difficult to get approval for a rise in levies, taxes, and tolls, as well as because there is insufficient control, management, and monitoring of road tolls and car licences. Malfeasance and a failure to collaborate have hampered the RF's few income streams (International Federation of Societies, 2016).

The consolidated fund refers to funds from the nation's coffers and is derived from tax income and various taxes imposed by the government. Money raised here goes toward creating brand-new initiatives (Dalal *et al*., 2010). Approximately fourteen per cent of all public project financing comes from this source (Twumasi-Ampofo *et al*., 2012).

3. Key challenges facing public sector funded projects

i. Payment Failures

Payment for works executed is very paramount for the continual function of the industry (Supardi and Adnan, 2011; Abdul-Rahman, 2011). Ramachandra and Rotimi (2015) concurred that payment is central to all economic transactions and that with the absence of charge, no person can flourish in business. Nonetheless, the industry recognizes that issues confronting payment, such as overdue and non-payment, continue to be a significant concern (Ye and Rahman, 2010; Ramachandra and Rotimi, 2015). According to Paul *et al*. (2012), late payment occurs when payment is not received on the stipulated date. According to the Construction Industry Working Group on Payment (2007) and Ye and Rahman (2010), payment irregularities at the top of the pyramid will result in significant cash flow issues further downstream the contractual chain (Morellec *et al.,* 2013).

Additionally, Morellec *et al.* (2013) noted that payment failures result from the following: the client's poor financial and business management, the client's refusal to pay, the contractor's unacceptable claim, the consultant's delay in valuing and certifying interim payments, the consultant's inaccuracy in valuing work performed, the consultant's inadequate documentation and information for valuation and the participation of many stakeholders in the process of issuing payment certificates.

ii. Cash Flow Issues

Construction projects are complex and highly risky. According to Laryea (2010), the difficulty in forecasting cash flows implies that banks see contractors as a greater risk, resulting in a high cost of financing for construction enterprises. Effective cash flow management is critical for survival in this continuously changing economy (Liu *et al*., 2009). When analyzing a project's cash flow, cash flow forecasting is critical for avoiding cash flow difficulties (Morellec *et al*., 2013). The next step is to identify and implement strategies to ensure the project's cash flow remains sufficient. Thus, a well-managed cash flow will increase the project's cash flow and, as a result, the project's on-time performance. Arafat and Skaik (2016) assert that financial promises cannot be met without cash flow. Because project funding is based on loans with no or limited recourse against the project sponsors, both lenders and Special Purpose Vehicles' (SPV) shareholders must carefully evaluate the venture's potential to produce adequate cash flows to cover operational expenses, debt payment, and dividends to sponsors (Gatti, 2013). Nonetheless, negative cash flow has several negative repercussions for construction projects, including schedule delays, capital lock-up, bankruptcy, litigation/arbitration, and project abandonment/failed projects (Ahmed *et al*., 2003; Abdul-Rahman *et al*., 2006; Abdul-Rahman *et al*., 2009).

iii. Change in Political Leadership

Leadership is critical in all aspects of life. According to Ofori and Toor (2021), leadership is crucial in the construction sector. It is required at all levels of the construction sector, including building projects, enterprises, professional institutes, and trade groups (Ofori and Toor, 2021). According to Laryea (2010), contractors expressed dissatisfaction with the Ghanaian contracting environment and its politics. Each government seeks to promote its group of contractors, seeing contractors as a valuable source of funds for political campaigns.

Most contractors indicated that "Political Leadership" is a critical concern (Laryea, 2010). Society has lost faith in leaders due to some high-profile business CEOs' unethical management methods and poor leadership (Ofori and Toor, 2021). Such deficiencies in paperwork and documentary proof result in the contractor being unable to access such funds or causing a delay in the transfer of such payments to contractors (Morellec *et al.,* 2013). Additionally, Darcha (2006) puts this as the third most significant reason for abandoned initiatives. This component was included in response to the recent suspension of payment for work completed under the previous administration.

4. Effects of funding challenges on public sector projects

Funding is identified as a vital facilitator of any country's growth and development. Each building project needs ongoing financing to ensure its success (Yescombe, 2002). Contractors working with the public sector have noted that they face several obstacles while working on projects supported by the public sector in Ghana (Ofori *et al*., 2017). Several, contractors revealed that barriers such as delayed government payments, insufficient cash flow, change of government, and bureaucratic processes involved in obtaining funds from financial institutions impede the successful execution of public sector projects, ultimately resulting in their abandonment (Twumasi-Ampofo *et al*., 2012). Additionally, Sewalk *et al*. (2013) confirmed that several construction project contracts were cancelled owing to a lack of finance at the start of the economic crisis in 2008. Funding constraints impede project implementation for various reasons (Federal Highways Administration, 2017). Historically, governments' overseas borrowing has been primarily used to reduce the adverse effects of project funding dilemmas (Ngowi *et al*., 2006). Additional costs associated with project investment and finance challenges seem to be the primary reasons behind Ghana's poor growth in infrastructure development (Ngowi *et al*., 2006). The industry's importance is felt more acutely in underdeveloped nations because development projects necessary for better living conditions are comparatively scarce. Ghana's situation exemplifies the present state of infrastructure in many growing economies.

Table I: Acknowledged Effects of Funding Challenges of Public Sector Projects

S/N	Effects	Reference
1	Cost overruns	Subramani Sruthi and Kavitha (2014); Amoatey *et al*. (2015); Asiedu and Adaku (2019)
2	Time overruns	Amoatey *et al*. (2015); Asiedu and Alfen, (2015)
3	Abandonment of projects	Aryeetey and Jane (2000); Amoatey *et al.* (2015); Okereke (2017)
4	Difficulties in attracting foreign loans	Mmieh and Owusu-Fimpong (2004); Ngowi *et al*. (2006); Ofori (2012) Osei (2013)
5	Decrease in revenue accruing to government	Eyiah and Cook (2003); Mogues and Benin (2012)
6	Decrease in economic activities	Hillebrandt, (2000); Huang and Hsu (2003); Myers (2016)
7	Wastage of resources	Teo and Loosemore (2001); Hwang and Yeo (2011); Ajayi *et al.* (2015)
8	Reduction of employment opportunities	Briscoe *et al*. (2000); Enshassi *et al.* (2015); Ibrahim *et al*. (2015)
9	Lowering of living standards	Allen et al. (2011); Avdeeva *et al.* (2018); Bleynat *et al.* (2020)
10	Disappointment of nation's citizens	Berdún and Guibernau (2007); Zucman (2015)

11	Inability to occupy building projects on time by the end users	Kaliba *et al.* (2009); Doloi *et al.* (2012)
12	Contractor claiming for interest on delayed payments	Ofori *et al.* (2017); Amoako (2011)
13	Conflicts between stakeholders	Ahadzie and Amoah-Mensah, (2008); Foster and Briceño-Garmendia, (2010); Dadzie *et al*., (2012b)

5. Research methodology

The research philosophy adopted for this study was undergirded by positivism (Ghansah *et al*., 2020; Debrah, 2020). The Positivist philosophy holds that theoretically-based hypotheses can be verified using evidence gathered from the objective universe (Nardi, 2018). A quantitative research strategy was further adopted in this study by using both primary and secondary data (cf. Ogunsanya *et al*., 2019; Edwards *et al.,* 2020; Chileshe *et al.,* 2021). Data for quantitative research are usually collected using surveys, polls and questionnaires. A quantitative approach was used to amass the primary data via a structured survey questionnaire. Closed and open-ended questions were used - the literature review aided in the development of the questionnaire. Theories established in literature served as hypothesis for testing variables with respect to the objectives of this study. The questionnaire was divided into two sections viz: section one catered for the respondents' demographic information; section two of the questionnaire catered for the specific objectives of the study. The respondents were asked to rate each variable on a Likert scale of 1 to 5 (where 1: Strongly disagree to 5: Strongly agree). Section three invited participants to rank a close-ended five-point Likert scale (where 1: Strongly disagree to 5: Strongly agree). Mean values > 3.5 were significant (cf. Li *et al.,* 2005). The research strategy design adopted for the study was a descriptive survey research design. A descriptive study aims to describe, explain, or validate a finding (Nardi, 2018). In addition, the survey process served as the foundation for variable ranking and significance analysis using a one-sample t-test. This study also adopted the deductive approach, which posits that research results can be generalized to a larger population within acceptable error limits (Ary *et al*., 2018). The main advantage of the approach is its ability to use already existing theories to serve as hypotheses and, based on that, conclusions can be drawn based on the particular observation at a time (Lieberman, 2005).

The population of the study comprised contractors, government officials, donor agencies and consultants of these projects, constituting a population size of 282. A purposive sampling technique was adopted. This sampling technique is a non-probabilistic sampling technique in which the researcher chooses the sample base on his own judgmental perception (Saunders and Townsend, 2018). This strategy was adopted to target professionals with in-depth knowledge of funding challenges in the public sector. Therefore, preference is given to larger samples in establishing the correlation within variables and the cause-effect relationship in the study. Cochran's

sample size formula was used to determine the sample size for the study.

$$\eta = \frac{Z^2pq}{e^2}$$

η is the sample size

Z is normal standard deviation set at 1.96 for 95% confidence level,

p is the percentage of the populace with an attribute in question,

q is (1 – p)

e is the precision level desired or error margin, which is 0.05

For the study, p was taken as 90% thus 0.9, therefore q = 1 – 0.9 = 0.1

Z was taken to be 95%, thus 1.96 from the Z-score table below.

$$\eta = \frac{(1.96)^2 \times (0.9) \times (0.1)}{(0.05)^2}$$

η = 138.29

The sample size for the study is, therefore 138 respondents.

Statistical Package for Social Sciences (SPSS) version 25 software was used for data analysis. Specific research analysis methods employed were descriptive statistics, mean score ranking and one sample t-test—these analytical tools aided in ranking the phenomena and testing for significance. Collected data were analyzed and presented since it is expected that the data obtained from the survey were mainly nominal and ordinal. Tables and charts were used. Tables and graphs are inextricably linked. This is because the information represented in tables is generally used as the basis for plotting (or drawing) charts. They are significant because they may be used to communicate complex results acceptably (Saunders and Townsend, 2018). Additionally, the relevant non-parametric statistical approach, such as the one-sample t-test was adopted in further analyzing the data (effects of funding challenges). Because of the unpredictable existence of the population distribution and the fact that these results are due to chance rather than being a genuine representative of the whole population, the method is used in assessing the findings.

6. Data presentation and analysis

i. Demographic data of the respondents

Descriptive statistics were the statistical tool employed for the analysis. Ninety-one (91) questionnaires were retrieved out of one hundred and thirty-eight distributed representing sixty-six percent (66%) response rate, which consisted of: construction firms (frequency (f) = 52); Consultancy firms (f = 27); and government agencies (f = 13). Generally, a response rate of 60% is considered adequate, acceptable or marginal, 70% is reasonable or preferable, 80% is desirable or good and 90% is excellent in survey research (Davidof *et al*., 2002). Respondents for the study were asked to name the source of funding for their construction projects: Central government support (percentage (%) = 38); Internal generated funds (% = 28); Community source (%= 22); and donor support (% = 12). According to Kissi (2020), the respondents' years of experience are important in determining the legitimacy and reliability of the survey findings. With a minimum of five years of working experience, a worker qualifies for senior management role in Ghana (Kukah, 2017). This indicates that

respondents have the requisite knowledge to answer the questions and have an effective response. Out of the total retrieved questionnaires, 62 participants, representing 68%, were males, while 29 representing 32% of the sample were females. Zitzman (2020) ascertained that "in the male-dominated construction world, women are still encountering glass ceilings but are also breaking the mould of people who build. The construction industry is male dominated. Hence the reason for such a representation of the female respondents. Majority of the respondents were within the age category of 31-40 years, representing 52% of the sample, whereas 83% of the professionals had either a bachelor's degree or a master's degree. The age category indicated that the respondents were moderately aged. On average, the respondents had 8.22 years of practical experience in the construction industry. These statistics justify the credibility of the respondent's involvement in the construction industry.

ii. Mean score ranking on effects of funding challenges of public sector projects

Mean values and standard deviations were used for the ranking that the variables used for this study.

Table II: Demographic Table [frequency (f)=9]

Study parameter	**Variable**	**Frequency(f)**	**Percentage (%)**
Gender	Male Female	62 29	68 32
Age group	20-30years 31-40 years >50 years	12 51 28	13 56 31
Level of Education	Diploma (HND) Bachelor Degree MBA/MSc. /MPhil. PhD.	12 49 25 5	13 54 27 6
Place of Work	Construction firm Consultancy firm Government agency	52 27 13	57 30 14
Source of funding	Central government support Internal generated funds Community source Donor funds	35 25 20 11	38 28 22 12

Abandonment of project ranked first as the most prevalent effect of funding challenges of public sector projects in the GCI. Time overruns came second with (M = 4.21and SD = 0.848). Cost overruns ranked third with (M = 4.17and SD = 0.767). Inability to occupy building projects on time by the end users ranked fourth with (M = 4.08 and SD = 0.685). Decrease in revenue accruing to government ranked fifth with (M = 4.05 and SD = 0.997). Though reduction of employment opportunities ranked thirteenth, it had (M = 3.41and SD = 0.651). This indicates that all funding challenges of public sector projects have significant effects.

iii. One Sample T-Test for Effects of Funding Challenges of Public Sector Projects

To map the effects of the funding challenges of public sector projects

within the GCI, the study reviewed the thirteen factors found using the lens of one sample t-test (see Table IV) to assess the relative significance of the factors. The study adopted a hypothesized mean of 3.5 (Uo) for one sample T-test signifying that the factors with mean of 3.5 or above are significant. For a one sample t-test, the hypothesis is formulated as: (Ho: U= Uo) and (Ha: U<, >Uo) – where: the null hypothesis (Ho) is that "the mean value is not statistically significant as a key effect of funding

Table III: Mean Score Ranking on the Effects of Funding Challenges of Public Sector Projects

Effects	Mean	Std. Deviation	Ranking
Abandonment of projects	4.29	0.996	1st
Time overruns	4.21	0.848	2nd
Cost overruns	4.17	0.767	3rd
Inability to occupy building projects on time by the end users	4.08	0.685	4th
Decrease in revenue accruing to government	4.05	0.997	5th
Difficulties in attracting foreign loans	4.02	1.021	6th
Decrease in economic activities	3.97	0.784	7th
Conflicts between stakeholders	3.89	1.109	8th
Disappointment of nation's citizens	3.88	0.890	9th
Contractor claiming for interest on delayed payments	3.76	0.697	10th
Lowering of living standards	3.75	1.081	11th
Wastage of resources	3.70	1.187	12th
Reduction of employment opportunities	3.41	0.651	13th

challenges of public sector projects" whilst the alternative hypothesis (Ha) means that "the mean value is statistically significant as a key effect of funding challenges of public sector projects". According to Owusu-Manu *et al.* (2018), the 95% confidence level interval is used to analyze the differences between the population mean weight and the test score value of 3.5. The null hypothesis for each variable was that it had no significant influence on the primary effects of financing problems for public sector initiatives (Ho: U=Uo). Owusu-Manu *et al.* (2018) define Uo as the critical rating at which a variable is deemed significant. The p-value indicates the likelihood that random variables will exhibit values that are farther from the mean if the null hypothesis is true. Thus, the p-value is used to assess whether the null hypothesis should be rejected or not (Massey and

Miller, 2006). When employing a one-sample T-test, the null hypothesis is implicitly not rejected when the p-value is less than 0.05. (Ross and Willson, 2017). All components exhibited positive t-values (test strength), indicating that their means were considerably greater than the hypothesized mean, as shown in (Table III). Additionally, all variables identified as main impacts of financing constraints for public sector projects had a p-value (significance of the test) less than 0.05, indicating that their means do not deviate substantially from the hypothesized mean of 3.5. As a result, the null hypothesis is not rejected, and all variables reflect the impact of financial constraints on public sector initiatives in the GCI. For all variables, the degree of freedom (df), which refers to the total number of observations minus the number of applied independent restrictions, was 91.

Table IV: One-Sample Test of Effects of funding challenges of public sector projects

	Test Value = 3.5					
Effects					**95% Confidence Interval of the Difference**	
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Lower**	**Upper**
Abandonment of project	12.486	91	0.000	.67647	.89	1.29
Time overruns	10.929	91	0.000	.26471	.87	1.23
Cost overruns	9.046	91	0.000	.79412	.74	1.17
Inability to occupy building projects on time by the end users	8.492	91	0.000	.17647	.68	1.08
Decrease in revenue accruing to government	8.087	91	0.000	.08824	.59	1.03
Difficulties in attracting foreign loans	7.358	91	0.000	.26471	.54	.92
Decrease in economic activities	6.312	91	0.000	.61111	. 48	.90
Conflicts between stakeholders	5.336	91	0.000	.20588	.42	.84
Disappointment of nation's citizens	5.221	91	0.000	.02941	.37	.82
Contractor claiming for interest on delayed payments	4.789	91	0.000	.22222	. 32	.79
Lowering of living standards	3.887	91	0.000	.25926	.29	.64
Wastage of resources	3.413	91	0.000	.61111	.24	.52
Reduction of employment opportunities	2.989	91	0.000	.00000	.22	.45

7. Discussion of findings

Effects of funding challenges on Public Projects

Abandonment of projects was the most highly ranked effect of funding challenges of public sector projects in the GCI. Abandonment of projects encounters significantly complicate project delivery. According to Okereke (2017), abandoned projects are expected among developing country

people. This is attributed to the inadequate funds allocation for public projects in developing countries. Indeed, the industrial environment is strewn with abandoned projects in varying states of dereliction. Being a developing nation, Ghana has a slew of challenges in terms of project execution (Kissi *et al*., 2018). When a client cannot accept a delay, the project is abandoned. Numerous governments have committed considerable sums in developmental initiatives (Sweis *et al*. 2008; Sambasivan and Soon 2007), and Ghana is no different (Damoah and Kumi 2018; Amoatey *et al.,* 2015). Damoah and Akwei (2017) discovered that politically, public sector initiatives like building and education-related projects are seen as a means of garnering political support from public sector personnel. As such, the central government exercises direct control. As a result, their direct and indirect influence on their delivery may affect the delivery of public sector projects. Politically, concerns such as a change in administration have been cited as causes of the abandonment of post-colonial industrialization programmes and initiatives (Jeffries, 1982; Aryeetey and Jane, 2000). Without a doubt, the ranking reveals the influence of project abandonment on the financial issues faced by public sector projects.

Time overruns were the second most crucial effect resulting from finance challenges in public sector projects by the GCI. Kaming *et al.* (1997) and Annan (2003) defined project time overrun as the process of extending the length of a project beyond its initially projected completion date. Due to the objectivity with which time performance is evaluated and the immediate economic consequences of exceeding them, time performance has long been considered the most evident and essential criterion for assessing the success of construction projects (Ogunsemi and Jagboro, 2006; Faridi and El-Sayegh, 2006). On the other side, schedule overruns are common in the GCI, resulting in budget overruns and project cancellations (Asiedu and Alfen, 2015). Therefore, time overruns are a waste, reducing the amount of infrastructure constructed within a given financial commitment and depriving customers of early returns on their investments (Asiedu and Alfen, 2015).

Additionally, Famiyeh *et al*. (2017) claimed that the length of construction projects in Ghana had been a critical cause of worry lately, especially among consumers and beneficiaries, due to increasing interest rates, inflation, development plan objectives, and other elements. Despite a recent study on the factors contributing to construction project delays and cost overruns, further public-sector projects continue to go behind schedule, incurring additional expenses (Famiyeh *et al.,* 2017). This is congruent with the findings of this field survey, which revealed that delays in public sector projects due to financial issues were second only to 'noble' project abandonment.

Cost overruns were placed third in the GCI due to financing issues in public sector projects. According to Zhu *et al.* (2004), cost overrun is defined as the difference between the actual cost and the projected cost. The term "cost overrun" is also occasionally used to refer to "cost escalation," "cost increase," or "budget overrun." However, the cost criteria have been prominently highlighted in most definitions of project management performance, especially success. Certain researchers have identified additional unanticipated causes of construction project cost overruns (Asiedu and Adaku, 2019).

Technical factors include estimators' inexperience, imprecise forecasting approaches, honest errors, intrinsic difficulties in projecting the future, and insufficient data (Flyvbjerg *et al*., 2002; Flyvbjerg, 2005). Flyvbjerg *et al*. (2002, 2005) added political-economic and psychological causes for cost overruns in big infrastructure projects. A robust reporting and feedback mechanism is critical for successful project monitoring and cost management. However, the majority of public sector construction projects in Ghana lack effective monitoring and control mechanisms, resulting in project failures (particularly in terms of cost) (Asiedu and Adaku, 2019). Inability to control or manage cost overruns directly impacts the financing of public sector projects, which need a careful examination at the federal level.

Inability to occupy building projects on time as result of payment delays by the end-users (government). According to Durdyev *et al.* (2017), a project schedule is regarded as the most critical part of the construction management life cycle and as one of the primary factors influencing the project's success. Despite its established importance, most construction projects (both in developing and developed nations) have encountered timetable delays, making it a chronic challenge for end-users to occupy the facilities on time (Kaliba *et al*., 2009; Doloi *et al.,* 2012). This kind of circumstance is referred to as a project delivery delay. Delays in project delivery occur when the building contractor and the project owner/end-user jointly or severally contribute to the project's failure to be completed within the specified initially or agreed contract time. Uncompleted construction projects significantly influence the country's industry and economy. The inadequate finance/funds of the end user (government) and payments for completed work will relatively fail to occupy the project on time. As the 4th ranked variable, it is an open secret that the end-users have not occupied many government projects in Ghana due to delays resulting from insufficient funds.

From table III above, the following effects were ranked 5th to 13th respectively: decrease in revenue accruing to government, difficulties in attracting foreign loans, decrease in economic activities, conflicts between stakeholders, the disappointment of nation's citizens, contractor claiming for interest on delayed payments, lowering of living standards, wastage of resources and reduction of employment opportunities with each having a mean greater than 3.5. This showed that they are critical variables that constitute the effects of funding challenges of public sector projects in the GCI. Though the reduction of employment opportunities ranked 13th among the list, its criticality cannot be overlooked.

8. Conclusion and recommendations

The study enhances a considerable understanding of the effects of funding challenges associated with public sector projects in the GCI. Despite the exertions by governments tasked with providing financial resources for public projects, the accomplishment of this mandate is still unfinished. Inadequate financial resources have been blamed for this situation. Hence, several inappropriate encounters have been observed. Public-funded projects have suffered serious payment failures linked to a severe knock-on cash flow problem down the chain of contracts, affecting the contractors' ability to operate thoroughly. With mean score ranking as the analytical tool, the following five critical factors

(effect of funding challenges of public sector projects in the GCI) were identified, namely (in order): abandonment of the projects, time overruns, cost overruns, inability to occupy building projects on time by the end users and decrease in revenue accruing to government. From the study results, these factors were identified by respondents as being the main critical effects of funding challenges encountered on public sector projects in the GCI. Undeniably, public project financing plays a crucial role in successful project delivery. However, developing countries (DCs) lag in infrastructure stock, and Ghana is not an exception.

Consequently, delays in construction projects are prime to severe consequences that may retard the development of the construction industry and influence the overall economic condition of a country. Hence, delay in completing construction projects could be the most significant cause for extra cost and loss of financial return or other benefits from the projects. Thus, a delay is costly for both owner and contractor. To the owner, a delay means loss of potential revenue, while to the contractor, a delay means increased costs in overhead.

Given the difficulties governments face in funding public sector projects today and in the foreseeable future, it should be appreciated that private finance and planning mechanisms, as well as innovative means of financing of public projects, may enhance the governments' capabilities to address the nations' infrastructure problem. However, an appropriate planning framework is needed to help ensure that each project is chosen based on its potential to optimize economic growth and quality of life. All expenses and contingent liabilities should be included in the budget paperwork. Transparent data on capital projects can do much more than aid in the funding and execution of projects. It may contribute to instilling confidence in government officials, private sector investors and suppliers, and the general public that the nation can address the infrastructure deficit.

Additionally, the paper suggests that the government should guarantee a proposed financial plan based on a diversity of funding sources and financing instruments related to a project's life cycle phases. The parameters for developing the financial strategy should be defined so that they improve the mechanisms for attracting capital for the project, increase the project client's capacity to repay debts, and ensure the timely honouring of certificates for contractors to complete projects within the contract duration. Finally, it is advised that the government integrate "Co-financing" Under this arrangement, the government would contribute a percentage (say 50%) of the overall funding demand in a low-interest loan, reflecting the government's lower cost of capital. It woud lower the cost of financing and expand the pool of funding available. Bank financing keeps the emphasis on cost management, while the engagement of a government lender would stimulate further financing since the market would have increased confidence in the projects.

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Relative adoption of risk management strategies in real estate development in Lagos State, Nigeria

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Abstract

Despite the critical need for managing risks that cause project delays and cost overruns in real estate development in Nigeria, suboptimal research has been conducted on adopting managerial approaches to risk management in the industry. Exploring risk management strategies is necessary for an inherently risky process. This paper focuses on real estate development firms in Lagos State, Nigeria. Using the survey method, findings are based on the responses from the sixty-eight returned questionnaires from real estate development firms. Descriptive statistics such as percentages, mean rating and relative adoption index were used to analyse the data. The study established that relatively, the most frequently adopted risk management strategies in real estate development were resource risk management strategies (RII = 4.26), personnel risk management strategies (RII = 4.11), and project control risk management strategies (RII = 3.76). The study recommends a total shift from the traditional approach to risk management in real estate development to managerial approaches. There is also the need for sensitisation programmes by the Nigerian Institution of Estate Surveyors and Valuers and other professional bodies that deal with real estate development on the risk management strategies for the successful completion and delivery of real estate projects.

Keywords: *Real Estate Development, Risk Management, Risk Management Strategies, Relative Adoption, Lagos State.*

1. Introduction

Real estate development is one of the most dynamic, risky, and challenging businesses. However, the industry has a very poor reputation for managing risk, with many major projects failing to meet deadlines (Babawale and Olusola, 2009; Okeahialam, 2012; Otegbulu, Muhammed and Babawale, 2011; Wiegelmann, 2012). The execution of real estate is a very complex and multi-disciplinary task as it needs a dedicated team of people with different skills and expertise and the coordination of a wide range of interconnected and interrelated activities. The increasing phenomenon of building collapse and abandonment in Nigeria has been attributed to a lack of efficient risk management strategies (Ogunbayo, 2018; Jagun, Daud and Samsudin, 2019). These included, among others, the retrogressive attitudes of parties involved, the absence of culture for the firm, low involvement of professionals, lack of standard risk management processes, lack of a good plan for activities, low level of formation of capital to which efforts could be managed and the existence of a wide gap between academic researchers and the practitioners (Francis and Usen, 2016). According to Okeahialam (2012), most real estate projects in Nigeria experience cost variations and completion delay problems due to the high negative effects of associated risks. Studies such as Bahamid, Doh and Al-Sharaf (2019); Saad,

Anjali and Umair (2021) have established that the high negative effects of risk exposure in the Nigerian real estate industry were a result of poor risk management strategies. Therefore, it is expected that for successful real estate projects to be realised within the stipulated time and costs, emphasis should be placed on applying and implementing appropriate risk management strategies.

Risk management is "an activity, which integrates identification of risks, measurement of risks and the development of strategies to manage them using managerial resources" (Moorhead, Armitage and Skitmore, 2021; Jagun, Daud and Samsudin, 2019; Wiegelmann, 2012). It is an area of specialisation that addresses the possibility of future events causing adverse effects. The basic goal of risk management is to minimise risks and their impacts to realise the property within the scope of predicted time, projected cost, and reasonable quality.

In the context of African countries, especially developing nations, risk management in real estate development is a very complex task characterised by greater risk exposure when compared with the developed world (Khedeka and Dhawale, 2015; Milka, 2016). The level of adoption of risk management strategies has not been widely studied. In Nigeria, particularly in Lagos State, shreds of evidence abound of building collapses and delay with the associated negative consequences such as economic, social and environmental effects (Ogunbayo, 2018). Most development projects are commonly abandoned, and completed projects experience a void as they are not occupied even after a period of over six months after completion (Odimabo and Oduoza, 2013; Thomas, 2012). The overall outcome indicates that risk management strategies have not received significant attention in real estate studies, calling for more awareness through empirical evidence. By examining the various strategies for managing real estate project risks, this study investigated the relative adoption of managerial risk management strategies in real estate development in Lagos State, Nigeria.

2.0 Review of related literature

2.1 Real Estate Development Process

The term "real estate" encompasses land and any structure or building, including the air above it and everything under it. It ranges from residential to commercial offices, trading spaces to agricultural properties, specialised properties such as mosques, churches and hotels and industrial buildings such as factories (Khedekhar and Dhawale, 2015).

Real estate development is a part of a social, economic and political process involving the distribution and control of resources (Francis, 2020). It is a multifaceted business which invariably includes a combination of the following: coming up with an idea, refining it, testing its feasibility, negotiating contracts, making a formal commitment, constructing the project, completing and opening it, and, finally, managing the new project.

In the context of commercial and industrial real estate, Okeahialam (2012) opined that development normally implies the creation of new buildings, either as a result of a bare site being built on for the first time (new development) or as a result of the replacement of existing buildings by new structures (redevelopment) or even through structural conversion, alteration and modernisation of existing

buildings (Nnamani, 2016; Ogunba and Ajayi, 2018).

The main players in the real estate development market are developers, builders, real estate agents, tenants, and buyers (Khedekar and Dhawale, 2015). The developer is the party that motivates, coordinates, makes crucial decisions and bears the main financial risks of the project. The components of the real estate development process listed above are ultimately the developer's responsibilities, even though the bulk of the work may be undertaken by professional agents (Trume, 2013). Therefore, the developer takes risks, manages them, and tries to eliminate or minimise them or, at least, gets them down to a bare minimum. The development process describes the series of sequential activities from the conception of a development project to actual construction and the eventual disposal of the development.

2.2 Risk Management Strategies

Saad, Anjali and Umair (2021) described risk management as identifying the potential risks, evaluating their impacts and formulating appropriate strategies to manage them. According to Bernstein (2000), risk management is "the capacity to manage risk and with it the appetite to take the risk and make forward-looking choices". Similarly, Wiegalmann (2012) defined risk management as "a systematic and integrated approach to the management of the total risk that a company faces". The primary goal of risk management, according to Jagun *et al*. (2019) and Moorhead *et al*. (2021), is the "management of overall institutional risk across all risk categories and business units". The essence of risk management in real estate development is to realise the project within the predicted time, planned costs, and satisfactory quality. However, project realisation under the conditions of uncertainty leaves the outcome to be largely unpredictable. This is why converting uncertainty into risk and managing it is important.

Successful risk management has been observed to involve the application of sophisticated techniques and quantitative tools to quantify potential risk (Odimabo, 2016). Risk management strategies are, therefore, procedures for managing the risks of development projects, which have been quantified. Risk management strategies include risk avoidance, acceptance of risk with a plan to mitigate their impacts, risk transfer and risk reduction by mitigating the likelihood of their occurrences (Moorhead, Armitage and Skitmore, 2021).

Abotsi, Dake and Agyepong (2014) held that a comprehensive risk management process must be assured and made available for the Board and top management to identify and manage potential risks easily. This must show the organisation's risk profile concerning its capital. Risk management strategies are also specified in that activities that may negatively affect real estate development firm performance are first isolated, with the sole aim of managing them. Adopting the appropriate strategies for managing the risks would make it convenient for the organisation to improve performance (Ahmed *et al*., 2007). Meredith and Mantel (2006) further noted that project control strategies are in the form of feedback loops, which signal to the management the discrepancies between the observed and the expected performance. However, the level of adoption of risk management strategies has not been widely studied. For instance, Charles and

Doreen (2018) observed that the low level of awareness of appropriate tools and techniques to effectively manage real estate development risks considering the dynamic nature of the corporate environment, participants in real estate development were exposed to high-level risk.

Risk management strategies in the real estate development process specifically are nonetheless documented in studies such as David and Treshani (2018), Gehner, Halman and De Jonge (2006), Gehner (2008), Milka (2016), Moorhead, Armitage and Skitmore, 2021; Ondara (2017), Ugwu, Osunsanmi and Aigbavboa (2019), Viswanathan, Tripathi and Jha (2019), Wiegelmann (2012) and Wong (2013). For instance, the study of Ondara (2017) revealed that resource risk management strategies, personnel risk management strategies, and project control risk management strategies significantly influenced firm performance as real estate developers were utilising them in risk management. Similarly, the study of Moorhead, Armitage and Skitmore (2021) noted that personnel, resource, insurance, project control and litigation were the risk management strategies that developers were adopting in New Zealand and Australia. Others, as addressed in some studies, are financial and regulatory policy (Fraser, Leishman and Terbert, 2002; Kouame, 2016). However, the emphasis of these scholars has been centred on developed parts of the world with different cultures and economies and where efficient risk management strategies are being adopted.

A study was conducted by Milka (2016) to analyse the risks in real estate development with a particular interest in residential projects. The study adopted a descriptive questionnaire survey of real estate developers. The result of the study revealed twenty-six (26) risk factors that affect real estate development. By conducting a correlation analysis among the risk factors, the author established the likelihood of the occurrence of the risk factors and their impacts on project objectives. The study concluded that economic and financial risks impact project objectives more than other categories. Other risk factors with a high impact on project schedule and cost are: not meeting milestone deadlines, construction price escalation, fluctuation of the exchange rate, inflation and change in client's interests. Although the study of Milka (2016) was extended to cover the impact of the risk factors on project schedule and project cost, the study did not examine the adoption of risk management strategies in real estate development, which is the main concern of this study.

Similarly, Nnamani (2016) examined the applicability of quantitative techniques in residential property investment appraisal. The author sampled 44 estate surveying and valuation firms in Enugu to investigate the relative usage of the techniques in residential property investment appraisal. The study found that subjective assessment was the most predominant risk analysis technique. The study further disclosed that no firm used probabilistic methods of risk analysis. However, this study mainly focused on risk identification and analysis; it ignored other aspects of the risk management process. Besides, the study was only confined to residential property development, an aspect of real estate development projects.

In another study, Otegbulu, Mohammed and Babawale (2011) focused on risk assessment techniques in real estate development in Abuja. The study sampled 80 estate

surveying and valuation firms. The study showed social, political, and economic risks as common risks associated with real estate development. The study further revealed scenario/sensitivity analysis as the most often used technique by the firms. However, the study only focused on real estate development risk factors and risk analysis techniques. Therefore, the study did not identify the risk management strategies for the identified risks in the real estate development stages.

Previous research in Nigeria that focused on real estate development risks field include those of Nnamani (2016), Odimabo and Oduoza (2013), Ogunba (2002), Ogunbayo (2018), Okeahialam (2012) and Otegbulu *et al.* (2012). However, these studies mainly focused on risk identification or risk assessment, which are fundamentally one aspect of the two components of the risk management process. The studies did not identify the risk management strategies to combat risk factors in the various phases of real estate development. Hence, there seems to be little information on the adoption of risk management strategies by real estate developers in Nigeria, necessitating new knowledge to fill this gap.

3.0 Methodology

The study area was Lagos State, and it was chosen because it is the centre of commercial and economic activities in Nigeria. This makes real estate development relatively higher than in any other part of the country - the study related to firms with core competence in the real estate development sector. Therefore, the target population for this study are the real estate development firms in Lagos State. Furthermore, because of the focus on the functionalities of the development firms, the empirical research was designated a firm-specific study. The reason for suggesting real estate development firms was that, as experts in property development, their primary business activity is the initiation and realisation of real estate projects.

Moreover, they were expected to better understand the risky nature of real estate development. Also, their previous records of real estate development concerning risk management strategies in their portfolio are very important and relevant for this study. The study used an explanatory research design, which connects ideas to causation. The researcher explained the relationship among the study variables. An explanatory research design was adopted because it involved collecting data from the population at a specific time. The study employed a field survey using structured questionnaire administration on real estate developers in Lagos State, Nigeria, through random sampling. The study adopted a five-point Likert scale to measure the risk management strategies under study. The key to the scale index used in the five-point Like scale was as follows: 5 = Mostly used, 4 = Often used, 3 = Rarely used, 2 = Of less usage, 1 = Not in use. A total of 101 questionnaires were administered, and 68 were retrieved and found useful for the study, representing a response rate of 67.3 percent. This is relatively acceptable in consonance with the submission of Asika (2012), which stated that a 60% response rate for survey research is considered acceptable. Data obtained from the survey were analysed using percentages, mean ratings and relative importance index. The relative Importance Index formula, as contained in Umeh (2018), is expressed as:

Equation 1 - $$RII = \sum \frac{W}{A*N}$$

Where

RII = Relative Importance Index,
W = Sum of weight given to each factor by the respondents.

4.0 Data analysis and presentation

This section is structured into two sections. The first section examined the profiles of real estate development firms. The second section contained the relative adoption of risk management strategies by real estate developers in real estate development.

4.1 Profiles of real estate development firms

From Table 1, the profiles of the responding firms revealed that they are largely experienced in real estate development as 61.81% of them have above 15 years of experience, are educated (86.76% possessed HND/B.Sc. certificate and above), are certified professionals (all respondents are registered members of their respective professional bodies) and 91.18% of the respondents are key members of the top management board, who make real estate development decisions in their respective firms

Table 1: Profile of real estate development firms

Parameters	Response Frequency	Percentage of Response
Year of Experience		
1-5	1	1.47
6-10	11	16.18
11-15	14	20.59
16-20	23	33.87
21^{+}	19	27.94
Total	**68**	**100**
Academic Qualification		
OND	9	13.24
HND/BSc	36	52.94
Masters	17	25.00
PhD	6	8.82
Total	**68**	**100**
Professional Background		
Architect	12	17.65
Builder	18	26.47
Engineer	22	32.35
Estate Surveyor	16	23.53
Total	**68**	**100**
Position in the Firm		
Lower Management Level	6	8.82
Middle Management Level	18	26.47
Top Management Level	44	64.71
Total	**68**	**100**

Source: Field Survey, 2021.

Table 2: Reliability Statistics for Risk Management Strategies Indicators

Risk Management Strategies	Cronbach's Alpha	Cronbach's Alpha Based on Standardised Item	Nr. of Items
Resource	.967	.983	5
Personnel	.816	.825	6
Project Control	.931	.946	7
Litigation	.904	.907	5
Insurance	.913	.918	4
Overall	.909	.913	27

Source: Field Survey, 2021.

From Table 2, the risk management strategies indicators –overall statistics showed that the measure of every strategy was greater than 0.7 on Cronbach's Alpha scale, indicating the internal reliability of all the data. In addition, the data collection tools were acceptable because they produced a reliability coefficient of 0.909, which is greater than the 0.7 thresholds for Cronbach's Alpha reliability coefficient. This indicated reliability and consistency among the five risk management strategies indicators. That is, all the variable measures in the five strategies satisfied the condition of usage by the study.

4.2 Relative adoption of risk management strategies in real estate development

Table 3 shows the summary of the results of the adoption of risk management strategies. In the Table, figures in parenthesis represent the percentages of adoption of each strategy by real estate firms across the study area. From Table 3, statistically, high-value means of all strategies indicated that respondents adopted the five real estate development risk management strategies. However, there were variations in the level of adoption of each strategy. For instance, Table 3 indicated that 'resource risk management strategies with RII of 4.26 were considered the most adopted risk management strategies. This was followed by 'personnel strategies' (RII=4.11). 'Project control strategies' (RII=3.76) and 'litigation strategies' (RII=3.75) were rated the third and the fourth normally adopted risk management strategies.

According to the results of the findings, the least adopted risk management strategies in the study area were insurance strategies, with a relative importance index of 3.66. The empirical data collected on adopting risk management strategies suggests that developers partially adopt a formal systematic approach to risk management in real estate development. However, there is clear evidence that development firms have not formally utilised litigation and insurance strategies. The study's findings further indicate that there is potential to improve risk management strategies among real estate developers.

Table 3: Mean ratings for risk management strategies in real estate development.

Risk Management Indicators	Mostly Used	Often Used	Sometimes Used	Of less Usage	Not in Use	Mean	RII
Resource Strategies							
Ensuring an adequate supply of quality	33(48.53)	27(39.71)	8(11.76)	0(0)	0(0)	4.37	
Ensuring the availability of valid land titles and documents	39(57.35)	26(38.24)	3(4.41)	0(0)	0(0)	4.53	
Ensuring the availability of plant and equipment	23(33.82)	28(41.18)	15(22.06)	2(2.94)	0(0)	4.06	
Ensuring optimal site condition	18(26:47)	32(47.06)	18(26.47)	0(0)	0(0)	4.00	
Preventing financial failure and delays in payment to contractors	28(41.18)	35(51.47)	5(7.35)	0(0)	0(0)	4.34	
Overall Mean						**4.26**	**1**
Personnel Strategies							
Ensuring a high availability of competent labour	37(54.41)	26(38.24)	5(7.35)	0(0)	0(0)	4.47	
Ensuring the availability of compliance enforcement agents on site	12(17.65)	19(27.94)	23(33.82)	14(20.59)	0(0)	3.43	
Ensuring the availability of safety officers	16(23.53)	28(41.18)	24(35.29)	0(0)	0(0)	3.88	
Ensuring formal training of site workers	18(26.47)	36(52.94)	14(20.59)	0(0)	0(0)	4.06	
Ensuring proper communication among the project participants	41(60.29)	22(32.35)	5(7.35)	0(0)	0(0)	4.53	
Ensuring the availability of workforce	30(44.11)	27(39.71)	11(16.18)	0(0)	0(0)	4.28	
Overall Mean						**4.11**	**2**
Project Control Strategies							
Ensuring adherence to technical specifications	11(16.18)	34(50)	20(29.41)	0(0)	0(0)	3.69	
Ensuring a reduced level of design errors and variations	29(42.65)	32(47.06)	7(10.29)	0(0)	0(0)	4.50	
Ensuring effective coordination of activities	23(33.82)	27(39.71)	18(26.47)	0(0)	0(0)	4.07	
Developing a time-phased budget for each task	12(17.65)	18(26.47)	11(16.18)	18(26.47)	9(13.24)	3.09	
Ensuring continued cost and schedule revisions	14(20.59)	15(22.06)	18(26.47)	16(23.53)	5(7.35)	3.25	
Forecasting schedule performance to ensure compliance	16(23.53)	18(26.47)	21(30.88)	9(13.24)	3(4.41)	3.47	
Ensuring effective coordination of project activities	31(45.59)	24(35.29)	12(17.65)	0(0)	0(0)	4.22	
Overall Mean						**3.76**	**3**
Litigation Strategies							
Allocation of contract risk to ensure fair distribution of risks among all participants	10(14.70)	20(29.41)	26(38.24)	12(17.65)	0(0)	3.41	

Drafting dispute clauses to include explicit provisions and instructions for dispute resolution	10(14.7)	24(35.29)	31(45.59)	3(4.41)	0(0)	3.60	
Ensuring contractual understanding among all stakeholders	22(32.35)	21(30.88)	17(25.00)	8(11.76)	0(0)	3.84	
Provision of neutral arbitration to provide alternative dispute resolution	18(26.47)	20(29.41)	22(32.35)	6(8.82)	2(2.94)	3.68	
Ensuring the use of contract wording that avoids ambiguity	31(45.59)	25(36.76)	7(10.29)	5(7.35)	0(0)	4.21	
Overall Mean						**3.75**	**4**
Insurance Strategies							
Ensuring low insurance premiums to increase uptake of insurance cover	14(20.59)	18(26.97)	25(36.26)	7(10.29)	4(5.88)	3.46	
Presence of adequate re-insurance facilities	11(16.18)	15(22.06)	32(47.06)	18(11.76)	2(2.94)	3.37	
Ensuring a good working and ensuring relationship to improve real estate delivery	15(22.06)	19(27.94)	28(41.18)	6(8.82)	0(0)	3.63	
Ensuring good service quality to improve the firm's performance	22(32.35)	35(51.47)	11(16.18)	0(0)	0(0)	4.16	
Overall Mean						**3.66**	**5**

Note: Figures in parentheses are in percentages.

Table 4: Test of Normality of Data for Risk Management Strategies

Performance Indicators	Kolmogorov-Smirnov (a)			Shapiro-Wilk		
	Statistics	Df	Sig.	Statistics	Df	Sig.
	.081	62	.016	.925	62	.013

a. Lilliefors Significance Correlation
Source: Author's Data Analysis, 2021

5.0 Concluding remarks and recommendations

The study examined the relative adoption of risk management strategies in real estate development in Lagos State, Nigeria, intending to provide information that could guide real estate developers in risk management practice. In reference to the survey of some selected real estate development firms in the study area, the study established that the most adopted risk management strategies in real estate development by real estate developers were resource risk management strategies, personnel risk management strategies, project control risk management strategies, litigation risk management strategies and insurance risk management strategies in descending order of relative adoption index. This result corroborated the studies of Charles and Doreens (2016) and Ondara (2017) but with a lesser adoption rate. Hence there is a need for a complete shift from the traditional approach of risk avoidance to risk management in real estate development to managerial approaches. There is also the need for sensitisation programmes by the Nigerian Institution of Estate Surveyors and Valuers and other professional bodies that deal with real estate development on the risk management

strategies for the successful completion and delivery of real estate projects.

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An Opinion Survey on Traffic Congestion along the Federal University of Technology Akure Main Route during Peak Periods

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Abstract

Traffic congestion makes the transportation system sub-optimally functional and it simultaneously contributes to economic stagnation. Hence, urban traffic congestion has resulted in a high loss of labour productivity as well as a loss of several man-hours. Therefore, this study seeks to assess the performance of the FUTA junction - FUTA south gate route during rush hour periods, as well as examine the factors contributing to traffic congestion along the route to assess the impact on the road users, identify strategies to improve traffic flow along the route. The research employed a quantitative approach using a structured questionnaire administered purposively to a sample size of 384. Descriptive analysis was conducted using frequency distribution charts, mean, and standard deviation. Findings revealed that the performance of the route is relatively very poor considering the high dissatisfaction of the road users. The factors contributing to traffic congestion along the route were identified as the need for road expansion, roadside market, illegal parking, and lack of efficient mass transport. The study equally identified that the major impact on users is stress, noise pollution, air pollution, and adverse effect on business activities. The study hence recommended the expansion of road pavement for the route, and the provision of efficient public mass transportation.

Keywords: *FUTA, Peak period, Road Expansion, Rush Hour, Traffic Congestion.*

1.0 Introduction

The issue of road traffic congestion is a common problem in most urban cities around the world. This can largely be attributed to the frequent rural-urban drift which leads to overcrowding. Onyeneke (2018) supports this statement that rapid urbanization, economic activities, and commercialization are leading factors contributing to traffic congestion in Nigeria. In addition, the existence of poorly planned road networks is a major source of concern, especially in developing countries like Nigeria. More so, the growth rate of vehicle ownership in Nigeria is far greater than the provision rate of transportation facilities which consequently results in traffic congestion (Raheem *et al*, 2015). Although there is no widely accepted definition for traffic congestion, it is regarded as a situation in which the demand for road space is more than the supply (OEAC, 2007). Similarly, Ajayi, *et al* (2017) describes traffic congestion as a restriction to the movement of people and freight. Urban traffic congestion according to Shekhar and Saharka (n.d) and Sougata, (2017) involves the presence of high

vehicular queues, restricted movement, and increased travel times.

Rukunga (2002), categorized the causes of urban traffic congestion as recurring which is attributed to peak commuting periods at critical locations, and nonrecurring which is caused by spontaneous occurrences. Igbinosun and Izevbizua (2020) identified factors such as poor road maintenance culture, inconsistent national road policy, and unstable regulations as disruptions to free traffic flow. Poor driving habits, poor road network, inadequate road capacity, and lack of parking facilities have been identified by a study conducted by Joseph and Anderson, (2012), as the greatest causes of traffic congestion in Nigeria. Given these, just like other urban cities, the causes of traffic congestion in Akure are not different from those identified. Furthermore, Akinse *et al.* (2016) in their study discovered that an average of 93.75% of buildings have encroached into the right of way limits along the FUTA road. Hence the call for redesign and reconstruction.

According to EIU (2013), socio-economic costs such as environmental degradation, delays, decreasing productivity, wasted energy, and diminished standard of living arises from traffic congestion in Nigeria. Hence, it is imperative to find lasting solutions to this social menace.

1.1 Statement of the problem

Generally, the lack of organisation in the construction and maintenance of the various road networks and the absence of a reliable national road policy, unbalanced regulation, and application of road standards are some of the characteristics of Nigerian roads (Igbinosun and Izevbizua, 2020). Traffic congestion according to Weyusia (2006) generally makes the transportation system sub-optimally functional and it simultaneously contributes to economic stagnation. Nigeria, as the most populated country in Africa unfortunately cannot make substantial provisions around road networking, and transportation infrastructure especially in urban cities to ease traffic congestion. Thus, due to urban traffic congestion, the loss of labour productivity is high, as well as the loss of several man-hours (Onyeneke, 2018). Specifically, the route from the FUTA junction to FUTA south gate in the study area constantly experiences gridlock between the hours of 7 am - 9 am, and 3 pm - 6 pm which are rush hours, and traffic congestion along the route has led to students' coming late for classes, missing classes, university staff resuming late for work, among others, as well as fatigue which has a negative effect on productivity. This was justified by the authors' personal experiences, field observations, and negative comments from the majority of road users.

1.2 Objectives of the study

i. To assess the performance of the FUTA junction - FUTA south gate route during the rush hour period

ii. To examine the factors contributing to traffic congestion along the route and to assess the impact on the road users

iii. To identify strategies to improve traffic flow along the route

1.3 Significance of the research

The impact of urban traffic congestion is consequential on productivity, as well as social-economic activities. Hence, the free flow of urban traffic provides an efficient and convenient means of moving people and goods (Rukunga, 2002). Mututantri *et al.* (2015) in their study suggested the expansion of road widths, lanes, and walkway shoulders to meet the anticipated traffic demands and pedestrian requirements

of the near future. This solution according to Ruben and Renan (2013) would reduce travel time, increase fuel efficiency, and reduce vehicular wear and tear. On this note, the road design expansion along the FUTA junction – FUTA south gate proposed by the authors, among other results, findings and recommendations would go a long way in tackling traffic congestion along the route. This would consequently improve socio-economic activities, increase road users' satisfaction, boost worker productivity, and eliminate loss of productive man-hours due to traffic congestion.

2.0 Review of related studies

Several studies exist in the literature regarding the issues of traffic congestion in Nigeria and specifically around the study area. Related studies such as Ibili and Owolabi, (2019); Fadairo (2013); Laoye *et al*., (2016); Ogunyemi *et al.,* (2021); Oyedepo *et al.,* (2019); and Ogundare and Ogunbodede (2014) were conducted in Akure city focusing on traffic congestion. However, none of these studies considered the FUTA junction – FUTA Southgate route as shown in Table 1.

Table 1: Review of related studies

S/No	Reference	Objectives	Methodology	Major findings
1	Ogundare and Ogunbodede (2014)	to describe intra-urban transport circulation in Akure metropolis with its attendant traffic congestion situation and problems.	Field observation	The major cause of traffic congestion in the Central Business District of Akure is parking problems
2	Fadairo (2013)	An investigation into traffic congestion along Federal University of Technology Akure Road / Oja-Oba Road	Survey	The most prevalent causes of traffic congestion are poor driving habits, weather conditions, absence of traffic lights and/wardens, roadside parking, among others
3	Ibili and Owolabi (2019)	Investigation of traffic noise in Ondo town	Calculation of Road Traffic Noise (CoRTN)	Findings revealed that the equivalent noise level exceeded the World Health Organisation (WHO) and Federal Highway Administration (FHWA) limits
4	Laoye *et al*. (2016)	Examination of the Indices of traffic congestion on major roads in Akure	Traffic volume data during peak periods	The study predicted increased traffic volume along the route based on 10 years forecast
5	Ogunyemi *et al*. (2021)	Explored the impact of traffic congestion on road users	Questionnaire survey	Traffic congestion significantly affects productivity

3.0 Material and methods

The study deploys the use of a structured questionnaire

administered to the university community (comprising university workers, and students), the University's host community, and commercial motorists. This study population was selected because they constitute the majority of road users along the route. These respondents consented to participation in the survey if their identity would be anonymous. Hence, the authors ensured the anonymity of the respondents which increased the willingness of participants. The structured questionnaire had 3 major sections. The first section acquired demographic information from the respondents, while the second and third sections asked questions regarding the performance of the FUTA junction - FUTA south gate route during rush hour periods and the impact of traffic congestion on the road users respectively. The questionnaire components were adapted from the studies of Awoyemi *et al.* (2012) and Popoola *et al*. (2013). The Authors employed the use of a 5-point Likert scale (Very high – 5; High – 4; Medium – 3; Low – 2; and Very low – 1) and (Strongly Agree – 5; Agree – 4; Medium – 3; Disagree – 2; and Strongly Disagree – 1) to record the respondents' opinions on issues. Using Cochran's formula for sample size, a sample size of 386 was calculated as shown below. Previous studies such as Yusuf and Diugwu (2021); Mobayo *et al*. (2021) also adopted this approach. approach.

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where e = the desired level of precision (i.e. the margin of error),

p = the (estimated) proportion of the population which has the attribute in question,

q = 1 – p.

Thus

$$n_0 = \frac{1.96^2(0.5 * 0.5)}{0.05^2}$$

$n_0 = 384$

Thus, a total number of 384 questionnaires was distributed purposively to respondents. This sampling technique was selected because it gives the opportunity of selecting the respondents that the authors feel would provide accurate and correct information.

A total number of 254 questionnaires were returned, but 235 were valid responses (representing a 72.5% success rate) for data analysis. The data analysis was conducted using descriptive analysis with the aid of frequency distribution charts, with mean, and standard deviation.

4.0 Results and Discussions

4.1 Demographics of the respondents

Findings show that 147 (62.6%) males and 88 (37.4%) females participated in this survey. The age distribution of respondents. 80% of the respondents' ages fall within the age range of 18-39, while 20% of the respondents are 40 years and above. By category, findings also show that 24% of the respondent were University staff as shown in Figure 1. A total of 29% of the respondents were students, 35% belong to the University host community category, and 12% are commercial motorists.

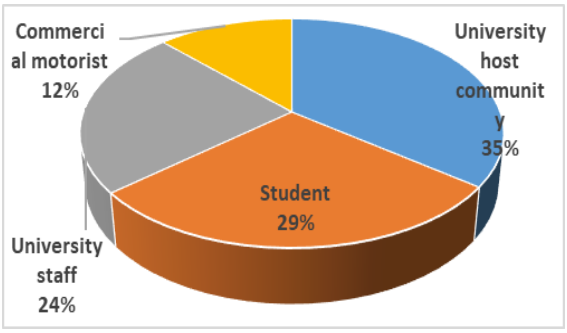

Figure 1: Category of respondents

Regarding the medium of transportation, 49% of the respondents use public transport, 41% use their vehicle, and 10% use motor-cycle as shown in Figure 2.

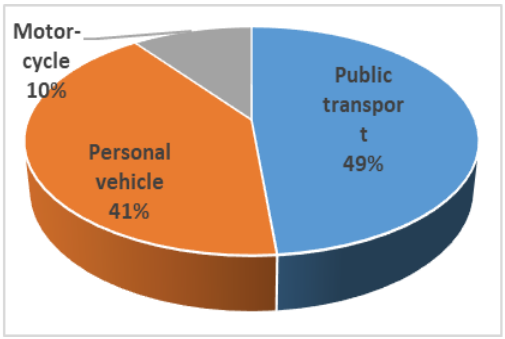

Figure 2: Medium of transportation.

Hence, the demographic features of the respondents validate their participation in the survey in providing valid responses to issues raised. The descriptive statistics also indicate that the respondents are regular commuters of the route..

4.2 Assessing the performance of the FUTA junction - FUTA south gate route during the rush hour period

The first objective of this study seeks to assess the performance of the FUTA junction - FUTA south gate route during a rush hour period. The rush hour period is the gridlock experienced between the hours of 7 am - 9 am and 3 pm - 6 pm along the route. Figure 3 shows that the majority (76.2%) of the respondents frequently ply the FUTA junction – FUTA south gate route for work, academics, and business activities. This is in contrast to the study of Awoyemi *et al.* (2012) where peak hours of traffic congestion in the Akure metropolis are between 8 – 10 am and 2 – 5 pm. Figure 4 shows that 85.5% of the respondents strongly agreed that the rate of traffic congestion is usually higher during rush hour periods (7 am - 9 am, and 3 pm - 6 pm) along the FUTA junction – FUTA south gate route. In addition, Figure 5 shows that the frequency of gridlock occurrences along the route is relatively high.

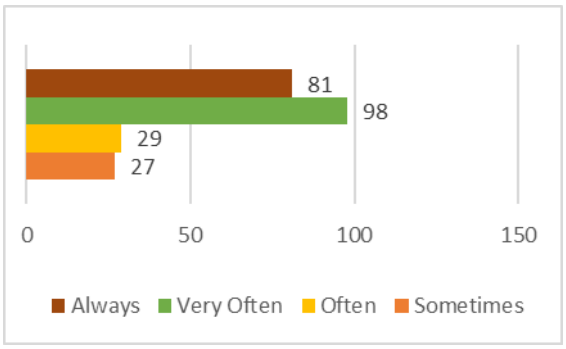

Figure 3: Frequency of plying the route

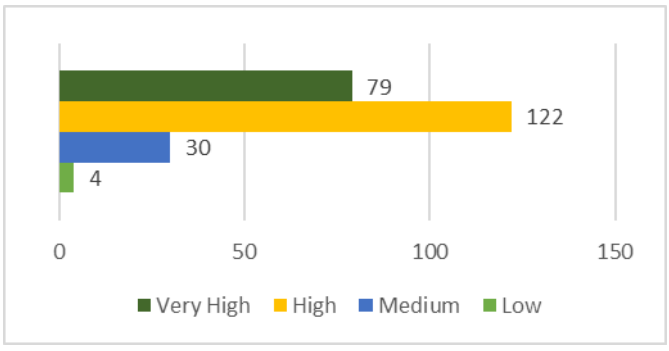

Figure 4: Nature of traffic congestion

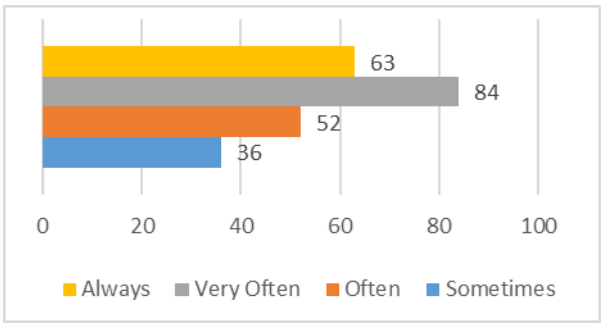

Figure 5: Frequency of gridlock along the route

This result is an indication of the heavy gridlock usually experienced

by commuters along the FUTA junction – FUTA south gate route. The majority of the respondents ply the route and a very small percentage of them (14.5%) believed that the traffic congestion along the route is medium or low. This high congestion is mostly attributed to the rush hour periods when students and University workers are resuming work in the morning and leaving in the afternoon.

4.3 The factors contributing to traffic congestion along the route

The study, through the opinions of respondents, seeks to identify factors affecting the free flow of traffic along the route to assess the impact of rush hour traffic congestion on road users. Findings presented in Table 2 show that the factors contributing to traffic congestion along the route are; the need for road expansion, roadside market, illegal parking, and lack of efficient mass transport with mean values of 4.42, 4.13, 4.08, and 4.01 respectively. This is quite similar to the findings of Awoyemi *et al.* (2012); Popoola et al. (2013); and Ajayi *et al*. (2017) which identified traffic holdup, road narrowness, bad roads, and scarcity of vehicles as the major issues. Similarly, Uwadiegwu (2014) categorized these factors into physical, technical land use, and human error.
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Table 2: Factors causing traffic congestion along the FUTA junction - FUTA south gate route

S/No	Causes of traffic congestion	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree	Mean Value	Std Dev.
1	Need for road expansion	-	1	26	81	127	4.42	0.70
2	Roadside market	6	11	27	94	97	4.13	0.96
3	Illegal Parking	4	22	19	96	94	4.08	1.00
4	Lack of efficient mass transport	6	11	32	111	75	4.01	0.93
5	Absence of traffic officers	4	28	33	88	82	3.92	1.05
6	Bad road (potholes)	34	27	45	95	34	3.29	1.26
7	Irresponsible Driving	23	62	34	70	46	3.23	1.30
8	Faulty vehicles	40	64	73	49	9	2.67	1.10
9	Road traffic accident	48	60	84	42	1	2.52	1.02

Source: Authors' Field Survey, 2021

Table 3: Direct impact of traffic congestion on the road users along the FUTA junction – FUTA south gate route

S/No	Impact of traffic congestion	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree	Mean Value	Std. Dev.
1	Stress	1		26	87	121	4.40	0.70
2	Noise pollution	-	4	33	73	125	4.36	0.78
3	Air pollution	-	9	35	100	91	4.16	0.81
4	Pedestrians	4	17	48	75	91	3.99	1.02
5	Work productivity	3	14	48	93	77	3.97	0.94
6	Business activities	4	9	73	78	71	3.86	0.95
7	Quality of life	3	27	55	73	76	3.82	1.05
8	Lateness to class	-	11	117	50	57	3.65	0.90
9	Missing classes	8	14	108	48	57	3.56	1.03
10	Road traffic accidents	54	63	70	31	17	2.55	1.19

N=235
Source: Authors' Field Survey, 2021

The direct impact of the rush hour traffic congestion according to respondents has led to stress, noise pollution, air pollution, pedestrians, and adversely affected business activities along the route over time. These and more are shown in Table 3. Additionally, findings revealed that the commuters were mostly delayed by 30 minutes – 1 hour (with a mean value of 4.06) due to rush hour traffic congestion. Asides from time wastage, the study of Popoola *et al.* (2013) identified the inability to predict travel time, fuel consumption, and emergency vehicles as other effects of traffic congestion.

4.4. Strategies to improve traffic flow along the route

Respondents were requested on a Likert scale of 1 – 5 (strongly disagree – strongly agree) to rate identified possible solutions to the problem of traffic congestion along the FUTA junction - FUTA south gate route. Findings in Table 4 thus show that expansion of road pavement, provision of efficient public mass transport, and sanction for illegal parking with mean values of 4.50, 4.49, and 4.23 respectively as the most recommended solutions to the problem. These findings are similar to those presented by Popoola *et al*. (2013). Contrarily, Li and Gao, (2014) proposed the two-way road lane needs to be reallocated to play the best role in managing congestion. This is because the two-way road flows are always unbalanced in opposite directions during the morning and evening rush hour.

However, the University host community category does not entirely agree with the prohibition of the roadside market which is mostly due to their direct benefits. In addition, Table 5 shows that commercial motorists with a mean value of 2.62 do not support that illegal parking should be sanctioned. Again, this is because they

are the category usually involved in illegal parking as they pick – drop – pick passengers along the route. Furthermore, students and University staff with mean values of 4.61 and 4.59 respectively strongly agreed efficient public mass transport should be provided as they stand to benefit the most.

Table 4: Strategies to improve traffic flow along the FUTA junction – FUTA south gate route

S/No	Strategies to improve traffic flow	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree	Mean Value	Std. Dev.
1	Expansion of road pavement	-	-	21	75	139	4.50	0.65
2	Provision of efficient public mass transport	-	-	18	84	133	4.49	0.63
3	Sanction for illegal parking	3	11	27	82	112	4.23	0.92
4	Road maintenance	3	15	30	67	120	4.22	0.98
5	Provision of parking spaces	3	11	33	92	96	4.14	0.91
6	The constant presence of traffic officers	3	19	24	84	105	4.14	0.98
7	Prohibition on the roadside market	18	58	40	59	60	3.36	1.30

N=235

Source: Authors' Field Survey, 2021

Table 5: Variation among respondents' categories

Category		Expansion of road pavement	Provision of parking spaces	Sanction for Illegal parking	Road maintenance	The constant presence of traffic officers	Prohibition on the roadside market	Provision of efficient public mass transport
University staff (N=56)	Mean	4.55	4.54	4.61	4.45	4.48	3.89	4.59
	S.D	.502	.503	.493	.630	.603	1.171	.496
Student (N=67)	Mean	4.57	4.46	4.67	4.72	4.37	4.21	4.61
	S.D	.633	.611	.533	.486	.775	.789	.549
University host community (N=83)	Mean	4.51	4.04	4.18	4.12	4.27	2.16	4.41
	S.D	.612	.740	.683	.903	.842	.862	.606
Commercial motorist (N=29)	Mean	4.24	2.90	2.62	2.90	2.62	3.83	4.24
	Std. Dev.	.988	1.345	1.049	1.345	1.049	1.037	.988

N=235

Source: Authors' Field Survey, 2021

5.0 Conclusion

The identified problem of this study was the frequent gridlock along the FUTA junction – FUTA south gate route due to rush hour traffic. The performance of the route is regarded as very poor based on the study's assessment of respondents' opinions. Furthermore, the severity of the direct impact of this traffic congestion on road users is relatively high. Road users have suffered from stress, noise pollution, air pollution, and adversely affected business activities due to traffic congestion. The major limitation of this study is the potential bias due to the sampling technique employed. Other sampling techniques or methodologies could be explored to investigate the traffic conditions along the route.

6.0 Recommendations

In line with the identified research problem, as well as the opinions from different categories of respondents, the following recommendations were drawn from the findings and previous studies such as (Laoye *et al*., (2016) and Ogundare and Ogunbodede, (2014));

i. Expansion of road pavement for the FUTA junction – FUTA south gate route.
ii. Provision of efficient public mass transportation along the FUTA junction – FUTA south gate route.
iii. Sanction for illegal parking.
iv. The constant presence of traffic officers ensures ease of flow of traffic and arrests traffic violators.
v. Off-peak vehicle usage should be introduced and enforced to reduce the frequency of vehicles on the roads.
vi. Efficient road maintenance

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Challenges and solutions to the adoption of building information modelling on construction projects in Nigeria.

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Abstract

This study investigated the problems and solutions to adopting BIM by construction experts in Nigeria. The objectives included identification of the challenges to BIM adoption and determination of important solutions. The Survey Method was used with purposive sampling to select 100 construction project experts in Lagos metropolis. The results show that the topmost challenges to BIM adoption are non-enforcement of BIM applications by private clients; lack of professional bodies' support; and absence of laws and policies. The most important solutions are standardisation by regulatory agencies and professional bodies' active participation. It was concluded that there are 12 key challenges and 15 important solutions to BIM adoption in Nigeria. The implication is that BIM adoption can be enhanced if professionals are cautious of these challenges. The study recommends that measures should be put in place to mitigate the challenges through adherence to the various solutions proffered in this study. This can be achieved by enlightening clients on the importance and benefits of BIM applications in projects so as to gain their confidence and support. The limitation was inaccessibleness of information on various stages of BIM, which is proposed as a focus for future studies.

Keywords: *Adoption, Building Information Model (BIM), Challenges, Solutions, projects.*

1.0 Introduction

Building Information Modelling (BIM) is a computerized presentation of useful and physical characteristics of a structure (Loh, Dawood and Dean, 2007). According to Wikforss (2006), project construction basically involves the coming together of several construction professionals with the aim of combining their expertise towards ensuring successful delivery of a project. According to Khalfan and Anumba (2000) BIM forms a control tool applicable to the process of construction, that is aimed at enhancing project performance. Construction projects are mostly fragmented and complex in nature, requiring the participation of different construction professionals, as key players in driving the implementation process and performance of projects (Kasimu and Usman, 2013). The BIM tool represents a system by which construction processes and tasks can easily be coordinated, directed and planned to ensure achievement of effective performance on building projects. Roshana and Akintola (2002) posit that the uniqueness of construction projects notwithstanding, performance of construction projects overtime has become one of the most important elements on which the usefulness and relevance of any construction project tool is based. Eastman, Teicholz, Sacks and Liston (2008) posit that BIM is a digital

tool that enables structures to be simulated prior to physical construction; thereby producing detailed documentation that would aid in making decisions, cost plans, design and processes that translate to effective performance. There are several levels of BIM implementation on construction projects, depending on its configuration and purpose. For instance, the National Building Specification (NBS) in UK published a guide explaining four levels, BIM Level 0 to BIM Level 3 (NBS, 2017). Awwad, Shibani and Ghostin (2020) suggest that although BIM implementation is high among large companies in UK, it's extremely low for smaller companies. The situation is worse in Nigeria due to several factors or challenges. The adoption by construction professionals is still low because of technological barriers, lack of policies, and associated cost of training. Four categories of 15 success factors for BIM implementation in small companies in UK were identified by Awwad *et al.* (2020). However, there are not many previous works on the difficulties of BIM applications in Nigeria, and this study seeks to bridge this gap. Therefore, the aim of this work was to investigate the challenges of adopting BIM applications by construction professionals and proffer solutions to them. The significance of this study is in stimulating stakeholders to the use of BIM to improve project performance.

2.0 Literature Review

2.1 Benefits of BIM

BIM presents several gains and prospects, which are aimed at ensuring successful delivery of projects and better project performance. It entails improved supply chain management, improved collaboration during projects, effective scheduling and design coordination, precise and quality drawings and identification of clashes (Becerik-Gerber, 2010). Other recognized benefits of BIM are reduction in risks, errors and net cost; and appraisal of schemes and estimates with respect to whether they meet clients' requirements and specifications (Kubba, 2012). It also brings about significant reduction in construction time and change orders.

Hergunsel (2011) opines that BIM enhances built to design and design to build, resulting into efficient construction. The application of BIM starts during the pre-design stage of building projects. BIM has many pros apart from visualization; such as 3D renderings with little effort. Azhar, Hein and Sketo (2011) show that BIM can be used at design phase for clash identification, interference and disagreement; all major elements can also be confirmed as BIM is done to scale. It implies that a major utility of BIM at the design stage of projects is prevention of all upcoming errors and issues that may impact successful upstream project delivery. BIM also plays a vital role in sequencing of construction activities. It can be used effectively for materials sourcing, programme delivery and support to the production of building components. BIM can also be used to carry out scientific analysis of building projects and helps in the management of facilities and operations (Azhar, Hein and Sketo, 2011). A BIM model can help to examine the services in a building by establishing a process and control for building management, fire evaluation and planning especially at the preliminary stage of design. In view of the aforementioned, BIM is not only useful for construction design and processes alone but can also be utilized in fire planning inspection during the design approval of projects.

2.2 Barriers to BIM adoption and implementation

The gains of BIM and related productivity are well noted and becoming more obvious as the industry is growing in the adoption of technologies and processes (Kreider and Messner, 2013; McGraw-Hill Construction, 2014); though the applications of BIM and its usage on construction projects is not without barriers which are impeding its adoption in the industry. Eastman (2008) opined that BIM is an interruptive tool, as it can have multiple effects on existing working guidelines, procurement methods, contractual and legal situation, data privacy and security, and insurances. Further, some of the barriers to BIM are connected to changes in organisation, cost of software and hardware, unavailability of related training and learning circle, general resistance to change by folks (Aranda-Mena *et al*., 2009; Arayici *et al*., 2011; Samuelson and Ab, 2010). The issues that are impeding BIM adoption are closely associated to firms' extent of BIM adoption; project processes of BIM application; and technological challenges. However, apathy to change is the most difficult barrier to BIM usage. It is a subconscious occurrence that when humans have achieved something great in a particular way, they feel good in executing the same task repeatedly. As BIM is bringing multifaceted changes in the approach to how professionals work and operate, firms are likely to face stiff resistance. Additionally, firms currently lack documentation of standards and workflows for BIM, have no established quality management system for BIM models and specific risk management policies, which are generally ratified and accepted. In this regard, Fox and Hietanen (2006) posit that other barriers include: firms not familiar with BIM applications; relaxed attitude of organisations in educating their staff on BIM applications; and anxiety of BIM not delivering anything new. London (2008) emphasised that an establishment's state of BIM implementation is reliant on the association between existing work practices and upcoming BIM set-up as perceived by the guidelines of an establishment. Thus, the extent to which BIM can transform the existing work practice is a critical factor in organisations to adopting BIM.

There are other issues that have to do with process level of BIM utilization like transmitting of information blockage, the current lack of parametric features for substantial products, BIM application is alien to programming and inadequate understanding of interoperability restrictions and capabilities (Manning and Messner, 2008). Froese (2009) opined that application of BIM on existing project management endeavours and procedures cannot be achieved except if there is reciprocal modification in organisation and skills of the project team. Henrik and Linderoth (2010) further stated that there is a critical need to review project roles in current building project set-ups at all levels to align with the project management needs for BIM. Also, the product stage of BIM application comes with barriers which are far more methodological and associated to BIM tool development and use. Its adoption in the construction industry is propelled by a new trend of technological concepts and several firms see it as only a grouping of some software tools. However, use of BIM technology is increasing and it is becoming more suitable for its purpose as its utility of realistic scenarios develops (Shafiq *et al.*, 2012). Other studies have emphasized that BIM technology is readily available, but there remain some huge challenges to ensuring its adoption generally (Samuelson and Ab, 2010; Alfred and Olatunji, 2011).The limitations of these impediments are not just hardware and software; but also procurement, understanding and education on new technology to aid the

application of BIM processes. In addition, construction researchers admit that there is a higher need for incorporation and interoperability of all software applications related to BIM and data sets for the entire BIM projects life cycle. People are a major limiting factor to BIM implementation. Several organizations see BIM as an excellent substitution for human resources, which influences the response of these professionals to adopting BIM, as they see it as a threat to their means of living. Therefore, the attitude of professionals to BIM must improve to ensure effective BIM application as it cannot be successfully deployed without human participation (Bengtson, 2010).

Chewlos, Benbasat and Albert (2001) highlighted the main issues to adopting BIM as inadequate know-how, individual clients not enforcing its use due to low awareness amongst them, the notion that the existing technology is adequate and lack of cooperation between professional bodies in ensuring its passage into law. Clients' ignorance of BIM also stands against its acceptance when suggested by professionals. Other identified factors include: huge application expense; complexity; inadequate training facilities; and absence of relevant regulations. Andy, Francis and Abid (2011) propose government's support as a major driver for BIM in developing countries (Alufohai, 2012). Thus, one of the major strategies to enhancing BIM adoption globally is through the promulgation of laws and policies making the use of BIM mandatory (Ibrahim and Bishir, 2012). There is a government legislation in UK since 2016 for the adoption of BIM Level 2 on all government projects of £5 million and above. Conversely, all the aforementioned are not existing in Nigeria.

3.0 Research Methodology

This study utilized the cross sectional survey method to elicit views of professionals in Lagos metropolis, a city in southwest Nigeria. It was considered because of the high volume of construction projects in the city. The population for this study was construction professionals (i.e. Architects, Builders, Civil Engineers, Electrical/Mechanical Engineers and Quantity Surveyors) in the study area. The sample size for this study was set at 100 construction professionals, drawn from the population of the study via the purposive sampling technique. This choice for this sample size aligns with the rules of thumb (Roscoe, 1975 as cited in Cavana, Delahaye and Sekaran, 2001). The rule suggests that a sample size which is more than 30 and less than 500 is appropriate for any academic research. A well-articulated questionnaire was created to retrieve data from the participants. The research had a 97% response rate. The questionnaire comprised three sections:

Section A: requested the respondents' demographic data.

Section B: identified the challenges of BIM adoption using a 4-point Likert scale, where 1= strongly disagree, 2= disagree, 3= agree and 4= strongly agree

Section C: proffered solutions to the challenges of BIM adoption on a 5-point Likert scale, where 1= Not significant, 2= slightly significant, 3= moderately significant, 4= Very significant and 5= exceedingly significant.

Mean, standard deviation, frequency and percentage were adopted to analyze the data.

4.0 Findings And Discussions

4.1 Demography of the respondents

The respondents' profile for this study was investigated. All the characteristics of each group were analysed and the results are as shown in Table 1.

Table 1. Profile of respondents and characteristics of BIM projects.

Variables	Frequency	Percentage
Gender of respondents		
Male	70	72.2
Female	27	27.8
Total	97	100.0
Highest level of Education of respondents		
OND	6	6.2
HND	33	34.0
Bachelors	36	37.1
Masters	20	20.6
PGD	2	2.1
Total	97	100.0
Profession of Respondents		
Mechanical Engineer	6	6.2
Civil Engineer	56	57.7
Electrical Engineer	5	5.2
Builder	11	11.3
Quantity Surveyor	6	6.2
Architect	12	12.4
Project Manager	1	1.0
Total	97	100.0
BIM Projects undertaken by respondents		
Yes	64	66.0
No	33	34.0
Total	97	100.0
Cost Range of Projects Completed by respondents		
₦1 - 50 million	8	12.1
₦51 - 250 million	30	45.5
₦250 million and above	28	42.4
Total	66	100.0

Table 1.0 result shows that 57.7% of the respondents are Civil Engineers, 6.2% are Mechanical Engineers, 5.2% are Electrical / Electronics Engineers, 11.3% are Builders, 6.2% are Quantity Surveyors, 12.4% are Architects and 1.0% are Project Managers. It can be inferred from the results that respondents whose opinions were sort are functioning in one area of construction or the other. As such, the respondents are categorized as knowledgeable and deemed fit to express reliable opinions related to the phenomenon under study. Also, 66.0% of the respondents affirmed that they have undertaken a project on which BIM was employed for its execution and completion; and 34.0% of the respondents affirmed that they have not. Therefore, the majority of the respondents can be regarded as people of practical experience in the application of BIM in projects. In addition, 12.1% of the respondents indicated the cost range of projects completed employing BIM as ₦1 - 50 million, 45.5% indicated ₦51 - 250 million and 42.4% indicated ₦250 million and above. The result therefore gives a critical overview of the cost range of projects completed employing BIM. Moreover, 72.2% of the respondents were males and 27.8% were females. This means that most of the respondents that contributed in the study were males, representing a fair view of the industry. Finally, 6.2% of the respondents have ordinary national diploma (OND) degree, 34.0% of the respondents have higher national diploma (HND) degree, 37.1% holds Bachelors degree, 20.6% holds Masters degree and 2.1% hold post graduate diploma (PGD) degrees. This implies that respondents whose opinions were sampled have good educational background and hence could provide reliable information on the study.

4.2 Challenges of BIM adoption by professionals in the Nigerian construction industry

The study examined key challenges impeding the application of BIM by professionals in the Nigerian built environment. To achieve this objective, 15 factors limiting the adoption of BIM in the construction industry were used. The challenges were assessed on a 4-point Likert scale, which are strongly disagree, disagree, agree and strongly agree. The results showing the mean scores are presented in Table 2.

The criterion for selecting any of the challenges are those for which the mean values are from 3 and above on the scale of measurement. It can be seen from Table 2 that about 12 of the 15 were selected by the professionals, and thus, are the challenges to BIM adoption in Nigeria. The highest ranked are nonenforcement of BIM usage by private clients and inadequate support by professional bodies in using BIM ranked 1st with mean score of 3.42 each; unavailability of standard regulations enforcing BIM ranked 3rd with mean score of 3.36 and so on. Issues that constitute challenges to the adoption of BIM by professionals in the Nigerian construction industry therefore revolve around the four aforementioned factors. The clients in the construction industry have been a key stakeholder and occupy a significant position in decision making that pertains to project implementation. The client decision with respect to the adoption or non-adoption of BIM in the implementation of projects is critical. Infact, one of the reasons why BIM has not been consistently adopted by professionals is because clients do not mandate its adoption in their construction projects. Instead, professionals are allowed to drive the construction process as they deem fit.

Table 2. Challenges of BIM Adoption by Professionals in the Nigerian Construction Industry

Factors	N	1	2	3	4	TS	StD	MS	Rank
Nonenforcement of BIM usage by private clients	97	1	9	36	51	332	0.719	3.42	1
Inadequate support by professional bodies in using BIM	97	-	11	40	46	332	0.762	3.42	1
Unavailability of standard regulations enforcing BIM	97	-	8	50	39	326	0.695	3.36	3
Uncertainty regarding BIM performance	97	1	16	39	41	316	0.794	3.26	4
Poor awareness regarding the application of BIM	97	3	15	41	38	309	0.821	3.19	5
Absence of support from the Government in using BIM	97	6	15	33	43	308	0.924	3.18	6
Inadequate research and development	97	4	19	34	40	307	0.921	3.16	7
Lack of expert staff	97	4	26	32	35	295	0.946	3.04	8
Cost and late updates	97	5	21	38	33	294	0.895	3.03	9
High cost of implementation	97	5	25	35	31	291	0.946	3.00	10
Unavailability of training facilities to support BIM adoption	97	6	28	25	38	291	1	3.00	10
Lacking of file exchange facilities and interoperability	97	2	19	54	22	291	0.736	3.00	10
Available technology is adequate	97	8	23	35	31	285	0.977	2.94	13
Decision making abilities	97	14	18	49	16	264	0.976	2.72	14
Complexity of BIM technology	97	5	28	56	8	263	0.749	2.71	15

If there were mandatory requirements from clients to adopt BIM, the reverse would have been the case. This is a major finding for lack of adoption of BIM by professionals in the Nigerian construction industry.

Inadequate support by professional bodies in using BIM also contributes to the challenges of BIM adoption in the Nigerian construction industry. If professionals came together to drive the adoption of BIM, this would have enhanced its adoption in construction far beyond what is seen in current construction activities. However, apathy in this regard has contributed to lack of adoption by individual professionals.

Furthermore, an analysis of variance was conducted amongst the variables on the challenges of adopting BIM. Variables with significant values less than or equal to 0.05 show that there is a significant difference between the construction organisations, but values greater than 0.05 means otherwise. The results are highlighted in Table 3.

Table 3. Analysis of Variance (ANOVA) on Challenges of BIM Adoption

		Sum of Squares	df	Mean Square	F	Sig.
Absence of support from the Government in using BIM	Between Groups	8.798	4	2.199	2.868	.027
	Within Groups	70.563	92	.767		
	Total	79.361	96			
Uncertainty regarding BIM technology performance	Between Groups	9.152	4	2.288	4.537	.002
	Within Groups	46.395	92	.504		
	Total	55.546	96			
Nonenforcement of BIM usage by private clients	Between Groups	1.284	4	.321	.639	.636
	Within Groups	46.221	92	.502		
	Total	47.505	96			
Unavailability of training facilities to support BIM adoption.	Between Groups	13.396	4	3.349	4.024	.005
	Within Groups	76.563	92	.832		
	Total	89.959	96			
Poor awareness regarding the application of BIM	Between Groups	3.208	4	.802	1.254	.294
	Within Groups	58.813	92	.639		
	Total	62.021	96			
Lacking of expert staff	Between Groups	11.865	4	2.966	4.190	.004
	Within Groups	65.125	92	.708		
	Total	76.990	96			
Inadequate research and development	Between Groups	9.816	4	2.454	3.558	.010
	Within Groups	63.442	92	.690		
	Total	73.258	96			
Lacking of file exchange facilities and interoperability	Between Groups	3.389	4	.847	1.709	.155
	Within Groups	45.601	92	.496		
	Total	48.990	96			
Available technology is adequate	Between Groups	21.392	4	5.348	7.694	.000
	Within Groups	63.948	92	.695		
	Total	85.340	96			
Unavailability of standard regulations enforcing BIM	Between Groups	3.211	4	.803	2.180	.077
	Within Groups	33.882	92	.368		
	Total	37.093	96			
High cost of implementation	Between Groups	18.988	4	4.747	7.163	.000
	Within Groups	60.971	92	.663		
	Total	79.959	96			
Cost and late updates	Between Groups	13.866	4	3.467	5.307	.001
	Within Groups	60.093	92	.653		
	Total	73.959	96			
Inadequate support by professional bodies in using BIM	Between Groups	2.511	4	.628	1.379	.247
	Within Groups	41.861	92	.455		
	Total	44.371	96			
Complexity of BIM technology	Between Groups	4.359	4	1.090	2.366	.058

	Within Groups	42.363	92	.460		
	Total	46.722	96			
	Between Groups	5.248	4	1.312	1.599	.181
Decision making abilities	Within Groups	75.474	92	.820		
	Total	80.722	96			

Table 3 reveals that the professionals differ significantly in their opinion on: inadequate support by professional bodies in using BIM; Uncertainty regarding BIM technology performance; unavailability of training facilities to support BIM adoption; poor awareness regarding the application of BIM; lack of expert staff; inadequate research and development; adequacy of available technology; high cost of implementation; and cost and late updates. This is because the p-values of all these challenges are less than the set 0.05. However, they are homogeneous in nonenforcement of BIM usage by private clients; unavailability of standard regulations enforcing BIM; absence of support from government in using BIM; decision making abilities; and complexity of BIM technology.

4.3 Solutions to the challenges of BIM's application in Nigeria.

Fourteen solutions to the problems of BIM's implementation by professionals in Nigeria were examined for significance. The significance of the solutions was measured on a 5- point Likert scale namely: not significant, slightly significant, moderately significant, very significant and exceedingly significant. The mean scores of the significance are presented in Table 4.

Table 4 affirms that all the identified solutions are significant, though at varying degrees. Regulatory agency standardizing its application for the industry ranked 1st has a mean score of 4.31; AEC professional bodies' active participation in BIM training is ranked 2nd with a mean score of 4.30 and implementing forms of contracts for intellectual rights is ranked 3rd with mean score of 4.27. Given the

Table 4. Solutions to the Challenges of BIM Application in Nigeria.

	N	1	2	3	4	5	TS	StD	MS	Rank
Regulatory agency standardizing its application for the industry	97	1	1	10	40	45	418	0.782	4.31	1
AEC professional bodies active participation in BIM training	97	-	3	10	39	45	417	0.779	4.30	2
Implement forms of contracts for intellectual rights	97	-	1	16	36	44	414	0.771	4.27	3
BIM collaboration of all construction professional bodies	97	-	3	12	45	37	407	0.772	4.2	4
Document lessons learned from the pilot projects	97	-	2	14	49	32	402	0.736	4.14	5

Incorporate BIM education in all built environment discipline courses	97	-	2	21	36	38	401	0.824	4.13	6
BIM cost subsidization for low/medium scale organisations	97	-	4	18	40	35	397	0.843	4.09	7
Undertake pilot projects to demonstrate the BIM outcomes	97	-	3	23	34	37	396	0.862	4.08	8
Restructuring of organisations to accommodate BIM software	97	-	4	18	48	27	389	0.797	4.01	9
Government mandatory use of BIM for AEC industry	97	2	3	17	50	25	384	0.865	3.96	10
Develop forms of contract for the insurance of BIM rights	97	2	4	27	28	36	383	1.004	3.95	11
Developing standard forms of contract integrating BIM	97	-	2	23	51	21	382	0.733	3.94	12
Expansion in availability of BIM technology	97	-	9	15	49	24	379	0.879	3.91	13
Reduction in cost of indemnities cover for insurance premiums	97	2	5	23	55	12	361	0.826	3.72	14

1= Not significant, 2= slightly significant, 3= moderately significant, 4= Very significant, 5= exceedingly significant, TS= Total Score, Std= Standard Deviation, MS= Mean Score, N=Number of respondents

forestated outcomes therefore, the solutions to the problems of BIM implementation by professionals are regulatory agency standardizing its application for the industry, AEC professional bodies' active participations in BIM training and implementation of forms of contracts for intellectual rights.

Standardizing the application of BIM for industries would foster its adoption in construction by the professionals in the industry. Beyond standardizing however, putting regulatory agencies in place would enhance monitoring for compliance with standards set. For instance, Olatunji, Oluwole, Sher and Willy (2014) found that reiterating the gains of BIM characteristics to clients, especially in cost estimating, enhanced their understanding of the services provided. It follows that if such measures were put in place, key stakeholders would be spurred to applying BIM in projects. There is also need for a more active participation of AEC professional bodies in training. Training plays a vital role and would enhance the capability of professionals in the application of BIM. Training provided by AEC therefore would provide relevant skills, knowledge, values, attitudes and competencies to be able to use BIM. The training would provide the needed information, essential skills and understanding of BIM. Among the advantages inherent in training are increased confidence and motivation, enhanced efficiency and effectiveness at task delivery. Professionals would become versatile in BIM operations. Likewise, the implementation of forms of contracts for intellectual rights could be leveraged on in the drive towards overcoming the challenges.

According to Rice, (2010) BIM is seen as an enabler helping the construction industry to improve its productivity by ensuring effective communication and teamwork amongst stakeholders from start through execution to closure of the building construction projects. Ibrahim and Bishir (2012) mentioned that part of

the better ways to advance the application of BIM within a country is by the enactment of relevant legislation and rules encouraging the use of BIM. These align with the findings of this present study.

5.0 Conclusion and Recommendations

This study established that there are issues militating against the adoption of BIM, while adequate measures that can resolve them have not yet been unearthed in Nigeria. These issues were investigated empirically among construction professionals in this study. Twelve key challenges confronting BIM in Nigeria were identified out of which clients' unwillingness to enforce BIM on their projects is topmost. It implies that a shift in clients' preference for BIM would improve its adoption in Nigeria. There are also 15 probable solutions to these problems; however, standardizing BIM usage by regulatory agencies is the most significant. The implication is that government agencies taking the lead in BIM adoption is critical to its success in Nigeria. In view of the aforementioned, it is suggested that the issues that constitute challenges in the implementation of BIM should be cautiously considered by construction professionals on projects and measures put in place to minimise them. This can be achieved by enlightening clients on the importance and benefits of BIM application in projects so as to gain their confidence and earn their support. Stakeholders can leverage on such measures as regulatory agency standardizing BIM applications, education and AEC professional bodies' active participation in BIM training. It is also imperative to establish legal frameworks (laws) and policies mandating the application of BIM in the Nigeria construction industry as proposed by the majority of the professionals surveyed.

This study contributes to theory and the industry by firstly establishing the factors hampering the full implementation of BIM in the delivery of construction projects, thereby drawing the awareness of stakeholders to these issues and enriching the body of knowledge of BIM, particularly in Nigeria and developing countries. Secondly, the improvement measures offered in this study for development and engagement by practitioners for smooth adoption of BIM application for construction project procurement can be regarded as a significant contribution.

Nonetheless, the study faced constraints in accessing information on various levels of BIM developments, either because the professionals did not have such information (it has been opined that BIM is at Level 0 stage in most organizations in Nigeria) or were unwilling to release it. Future studies should therefore be carried out on different levels of BIM developments (such as from PreBIM or Level 0 to Level 3 stages) using a mixed method approach for broader view and generalization.

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