

IMPLEMENTATION OF GREEN FINANCE AS A CATALYST FOR GREEN INFRASTRUCTURE DEVELOPMENT IN NIGERIA

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ABSTRACT

Purpose: The quest for environmental sustainability have become a global concern to every sector of life. The aim of study is to assess the level of commitment of financial institutions, and construction professionals towards green infrastructural development in Nigeria through green finance implementation.

Design/methodology/approach: A survey design approach was used in this study. A purposive sampling technique was used to select four hundred construction professionals, and ten financial institutions. Data collected were analysed using descriptive statistics. The study evaluated the level of awareness and implementation of green finance practices among construction professionals, and financial institutions in Nigeria. Critical inhibitors to green finance implementation in green infrastructure development were also assessed. The study revealed a response rate of 74.9%. Hence the response rate was adequate for the study.

Findings: The result showed that there is high level of awareness of green finance practices among construction professionals and financial institutions. In contrast to the level of awareness, the study revealed that there is low level of implementation of green finance practices in infrastructure development in Nigeria. Therefore, this study concluded that a high level of awareness does not lead to a high level of implementation of green finance practices. It was concluded that perceived high risk and low return on investment, fear of higher investment costs, weak financing structure, investors' lack of in-house capacities to assess greenness of bonds, capital constraint, lack of investor incentives, financial institutions incapability are the critical factors inhibiting the implementation of green finance practices in green infrastructure development in Nigeria.

Research limitations/Implications: The limitations of this study include the use of only four Cities in Nigeria. There is need to increase the number of cities and geopolitical zones as well as the sample size. This study has shown that high level of awareness of green finance practices did not lead to corresponding high level of implementation of green finance practices in the study area.

Practical implications: This study recommended that construction professionals operating in Nigerian built environment, and Nigerian banks should build their capacities towards meeting sustainable development goals. It is also recommended that incentives should be given to investors who want to develop green infrastructure.

Originality/value: The study has established the critical factors affecting the implementation of green finance practices in green infrastructure development in Nigeria.

Keywords: Driver; green finance; green infrastructural development; implementation; Nigeria.

1. INTRODUCTION

Environmental sustainability has become a global concern to all sectors of life (Schumacher et al., 2020). Africa has severely suffered the consequences of climate change such as rainfall volatility, extreme heat, drought, flooding, and sea-level rises (Connolly-Boutin and Smit, 2016; Muller, Waha,

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Bondeau and Heinke, 2014). These changes are beyond what is experienced in some other continents (Olivia, Adams, Baarsch, Coumou, Robinson, Hare and Reinhardt, 2017). These issues have worsened the level of transmission of communicable diseases in Africa (Connolly-Boutin and Smit, 2016). In response to these challenges, the government and relevant stakeholders are making various efforts to create environmental sustainability awareness, and this has increased level of awareness of climate change generally and the level of pollution contributed by the construction sector in particular (Volz, 2018). There is also great commitment to reduce level of economic carbonization, consider climate change' risks, and minimize the consequences of its operational activities (Hafner, Jones, Anger-Kraavi, and Pohl, 2020; Muhammad, Saputra, Hashim and Mohd Nor, 2019). Responding to these issues, Tolliver et al. (2020) noted that the government has an Agenda 2030 to achieve sustainable development based on the Paris climate agreement. The government needs to renew financial system innovation that shows more commitment towards environmental protection and economic growth in order to achieve sustainable development (Guild 2020).

The building and construction sectors create the enabling environment fit for human habitation. In addition, the construction sector creates the infrastructure needed for economic and social development of different group of people (Zhang, Wu, Shen and Skitmore, 2014). Heravi, Fathi, and Faeghi (2015) argued that the construction sector contributes considerably to environmental, social, and economic sustainability in developed and developing nations. This sector contributes significantly to the gross domestic product of many countries. Furthermore, the construction industry creates employment opportunities for the skilled and unskilled labour required for economic development (Dania, Larsen, and Yao, 2013; Esezobor, 2016). In the Nigerian context, the construction industry is one of the key contributors to national growth and development. Specifically, the industry contributed 3.71%, 3.72% and 4.51% in 2016, 2017 and 2018 respectively (National Bureau of Statistics (NBS) 2018a; NBS 2018b; Adewuyi and Ujene, 2019). Irrespective of the significant contributions to national growth and development, there are great concerns about the consequences of the construction industry activities on the natural environment. Some good examples include high energy consumption, massive wastes generation as a result of the activities of the construction sector, high utilization of raw materials and emission of toxic substances into the natural environment (Adewuyi and Otali, 2013; Windapo, 2014; Sirreck, 2017; Omuh, Ojelabi, Tunji-Olayeni, Afolabi, Amusan and Okanlawon, 2018; Jackson, Mustapha, and Kotey, 2019).

There is a general call for Nigeria to attain sustainability and achieved Sustainable development goals (SDGs) through adequate infrastructure, well planned and executed without harming the environment (Dalibi, Feng, Abubakar, Kumo, Danja, Mukhtar and Inuwa, 2020). However, infrastructure development needs sufficient and sustainable funding to sustain development through infrastructure projects that will drive balanced growth of the built environment in tandem with the social, environmental, and economic aspects of the physical and built environment. This situation calls for implementation of green finance principles or systems that will help to achieve a healthy natural environment (Li, Duan, and Zhao, 2018).

Green infrastructural development can be defined as long-term projects aimed at preserving, and protecting the natural environment, in addition to its economic and social benefits. Green development establishes a balance between the economic growth and sustainability of the earth (Mohd and Kaushal, 2018; Ferrara, 2020). Having known the enormous benefits associated with the implementation of infrastructure, one would wonder why it is so difficult for the government and other relevant stakeholders to implement green infrastructure in the society. This calls for critical evaluation of factors responsible for such situation.

Some studies in literature have identified critical factors affecting green finance practices in infrastructure development. These inhibitors include perceived high risk and low return on investment, fear of higher investment costs, financial institutions incapability, capital constraint, weak financing structure, and lack of clarity on what constitutes green finance activities (Mustaffa, Ahmad, and Bahrudin, 2021; Ametepey, Aigbavboa, and Ansah, 2015). Others include; green bonds lack clear pricing advantages compared to regular bonds, Investors' lack in-house capacities to assess greenness of bonds, lack of investor incentives, high inflation, and institutional quality. In addition, immature bond market, lack of harmonized system, risk of greenwashing, exorbitant cost of issuance, lack of green bond supply and under appreciation for bond potentials were also considered as barriers to green finance implementation in green infrastructure development (Amuakwa-Mensah, Klege, Adom, Amoah, and Hagan, 2018; Banga, 2019; Deschryver and De Mariz, 2020; Tu and Rasoulnezhad, 2021). Shan, Hwang and Zhu (2017) posited that a systematic review and

implementation of green construction project financing is lacking. However, Taghizadeh-Hesary, Zakari, Alvarado, and Tawiah (2022) posited that green finance implementation is at the early stage in Africa.

To overcome these challenges, the government and corporate institutions need to implement contemporary and innovative financial system (s) that focus on environmental protection and economic growth with a view to achieve sustainable development within the built environment (Swarnkar and Singh, 2016; Ahn, Jung, Suh and Jeon, 2016; Omuh, Ojelabi, Tunji-Olayeni, Afolabi, Amusan and Okanlawon, 2018; Mahat et al., 2019; Guild, 2020). The need to achieve sustainable development without compromising economic growth has become so imperative all over the world. Volz (2018) stated that it has become necessary for the financial sector to show great commitment towards achieving sustainable development goals. The study opined that the financial sector will have to play a central role in green development in developed, and developing nations.

Government of different nations have made some new policies. One of such policies is the creation of green financial system. It is a system that is environment focused. In this system, all activities are aimed at environmental improvement, energy saving, green financing, green investment, green transportation, and green financial development through project development, and effective and efficient utilization of resources (Tolliver, Keeley, and Managi, 2020). The concept of green finance is quite different from conventional finance. Green finance is innovative and environment oriented (UNEP Inquiry, 2016; Jha and Bakhshi, 2019; Falcone, 2020), and contribute significantly to the quality of life through corporate social responsibility carried out by the firms (Kemfert, Dorothea and Willi, 2020). Green finance is defined as financial investment flow from the banking sector, micro-credit, insurance and investment, the public, private and non- profit organizations to green infrastructure and initiatives (Lindenberg, 2014; UNEP-FI, 2014; Wang and Zhi, 2016).

On the basis of existing literature on green finance, most green development are financed through banks. By incorporating environmental concerns into their corporate decision making, banks can effectively and efficiently manage the risks associated with lending to polluting sectors and could help improve the resilience of the financial system (Mohd and Kaushal, 2018). Green finance plays a critical role in fostering the development of sustainable built environment (Marcelo and Daniel, 2013; HKFSDC, 2016; Volz et al., 2015; Soundarrajan and Vivek, 2016).

1.1. Objectives of the Study

The aim of study is to assess the level of commitment of financial institutions, and construction professionals towards green infrastructure development in Nigeria through green finance implementation. The specific objective of the study is to:

- i. Investigate the level of awareness green finance practices among financial institutions, and construction professionals in Nigeria.
- ii. Assess the level of implementation of green finance in infrastructure development among construction professionals in Nigeria
- iii. Evaluate the level of commitment of Nigerian banks to green finance in the construction sector in Nigeria.
- iv. Assess the factors inhibiting the implementation of green finance in infrastructure development in Nigerian built environment.

2. LITERATURE REVIEW

2.1. Green Finance Products and Services

The Green finance products and services reviewed under this section include green project finance/green Bonds, green insurance, green loan schemes, and green securitization.

Green Project Finance / Green Bonds

A green bond is a debt instrument whose profits are utilized to finance environment friendly infrastructure (green infrastructure). They are called green bonds because profits from these bonds are utilized only to finance green infrastructure. The International Capital Market Association (ICMA) (2019) defined a green bond as any type of bond instrument whose proceeds will be fully used to finance or refinance in part or in full, new and/or existing eligible green projects. The green

projects are waste recycling, water and resource conservation, air pollution control, green infrastructure, biodiversity conservation and so on (Mohd and Kaushal, 2018). The Nigerian Stock Exchange (2018) defined a green bond as any type of bond instruments where the proceeds are entirely used to finance or refinance, in part or in full, new and or existing eligible green projects that are tandem with the four fundamental components of the green bonds principles.

Goel (2016) revealed that demand for green bonds and green funds will increase because of the increased call and concern for green development. Wang and Zhi (2016) also revealed that green bond is an instrument balancing the relationship between environment and finance. One of the most effective instrument through which the private sector capital can be mobilized in the fight against climate change is through the issuance of green bonds (Oche, 2020).

Green insurance

This type of insurance classically has two product areas: (1) insurance products which differentiate insurance premiums based on environment related features (environmental risk assessment, environmental audit and management in all aspects); and (2) those mainly customized for clean technology and emission reducing activities. These are energy efficiency building insurance, green industry insurance, green nano-technology insurance, green auto insurance, and carbon offset schemes and so on. Green insurance schemes are those schemes which provide risk cover at a low premium and improved coverage for green products to minimize the impact of climate change, thereby promoting good corporate image and behaviour (Mohd and Kaushal, 2018)

Green loan schemes

Green loan schemes are the financing schemes offered by commercial banks and financial institutions at concessional interest rates aimed at investing in energy efficient projects. These include green mortgages / green home equity loans, green commercial building loans, and green car loans. Green mortgages / green home equity loans are loans that help induce households to purchase or install residential renewable energy, green residences with water and energy efficiency technologies or invest in retrofits. Green mortgages could be to finance the conversion of a house from conventional to green. In addition, Green Commercial building loans are attractive loans for green commercial buildings that consume lower energy, and resources (15-25%). These buildings are also characterized by reduced waste, green construction materials, reduced operating cost, enhanced performance and longer lifetimes. They have green features and functions, and less pollution than traditional buildings. Green Car Loans encourage the purchase of cars that ensure higher fuel efficiency with enhanced pollution control (Raghupati and Sujhatha, 2015; Mohd and Kaushal, 2018).

Green securitization

Securitization is the process of transforming a pool of illiquid assets into tradable financial instruments (securities). Majority of securitization is used to refinance loans to existing assets, and financial institutions (banks) are the main issuers of asset-backed securities. A securitization can be defined as "green" when it is used for low-carbon activities/investments or when the proceeds raised are used to finance green infrastructure loans. Green Securitization bonds are financial investments in a variety of emerging innovative environmental securitization techniques, including forest bonds; ecosystem-securitization programs; terrestrial and aquatic fauna securitization bonds and so on. Green securitization improves access to capital, for example by allowing small-scale projects to be grouped together and then securitized to a suitable size for bond markets. It also allows the cost of capital to be lowered, since asset-backed securities (ABS) issued in bond markets can offer a lower cost of capital than bank financing and this is important for green projects that characteristically have a high capital expenditure. Other green finance products and services include green cards, carbon Insurance, green venture capital and private equity, green fiscal funds, green investment funds, and carbon funds. Green cards are debit and credit cards connected to environmental sustainability activities. Green credit cards from large credit card companies offer to make environmental NGO donations equal to approximately one-half percent of every purchase, balance transfer or cash advance made by the card owner. Carbon insurance is described as insurance product offered by financial institution to manage carbon credit price instability. Green venture capital and private equity is capital base and finance for green infrastructure through specialized private equity units focusing on clean energy growth markets and investment opportunities in environmental sustainability (clean technologies, low carbon approaches, smart city and so on). Green Fiscal Funds is the exemption from paying capital gains tax with a discount on income tax offered to citizens who purchase shares in a green fund, or invest money

in a green bank. Investors can therefore accept a lower interest rate on their investment, while banks can offer green loans at a lower cost to finance environmental projects. Green Investment Funds are sustainable investment funds evolving three generations / steps. First generation funds exclusively employ social and environmental criteria; second generation funds use positive criteria that focus on progressive social and environmental policies and practices; and third generation funds use positive criteria to appraise and select potential green investments, with emphasis on relative performance within a sector. Carbon Funds help to finance greenhouse gas emission reduction projects to curb climate change. Carbon fund as a collective investment scheme which receives money from investors to purchase CO2 emission reduction credits (Ghahroudi, Rezaei, Oryani, and Tajdini, 2020; Wang and Zhi, 2016).

2.2. Green Finance in Developing Nations

There is strong agreement among relevant stakeholders that green finance should be a main concern in Africa, as it is in other regions of the developing and developed world. This type of funding is necessary for investments in “green” infrastructure projects across all sectors in order to stimulate and achieve sustainable growth on the continent. There is strong desire to reduce the poverty level and infrastructural deficit within the Africa continent (Duru and Nyong, 2016; Banga, 2019). One financial instrument that will generate the needed capital for sustainable development in Africa is the issuance of green bonds (Beschloss and Mashayekhi, 2019).

A World Bank study revealed that Africa has the highest infrastructure deficit compared to any other region (Rozenberg and Fay, 2019). However, only a small portion of global climate finance flows to Africa and on current trends investment levels will be too low to achieve many of the SDGs. Only 4% of climate finance flows (US\$ 331 billion) reached sub-Saharan Africa in 2013 (Obine, 2020; LSEG Africa Advisory Group, 2018; Duru and Nyong, 2016). An IMF study found a funding gap for low-income states, including those in Africa, to finance the SDGs of at least half a trillion US dollars that will need to be closed by 2030. This gap corresponds to an average of “15 percentage points of their GDP” (Gaspar, Amaglobeli, Garcia-Escribano, Prady and Soto, 2019).

The Nigeria's sustainable investment financing gap is nearly \$100 billion annually up to 2030. The financing gap for infrastructure alone is N36 trillion (or \$100 billion) every year for the next 30 years (Banga 2019; Amundi and IFC; 2018; Benhida and Mounsif, 2019; CBI 2019; LSEG Africa Advisory Group 2018; Obine, 2020; World Bank 2019; IFC, 2019).

3. METHODOLOGY

A survey design was adopted in the study, and a purposive sampling technique was used to obtain the sample for this study. Four hundred construction professionals were purposively selected from Abuja, Lagos, Port Harcourt, and Uyo in Nigeria. The choice of the cities was based on the volume of infrastructural development that are taking place in those cities. The criteria for selection of the professionals were age, years of experience, educational qualification, and professional affiliation. Ten financial institutions (banks) were also purposively selected. Copies of structured questionnaire were distributed to the construction professionals, and bank representatives by the researchers and research assistants. The construction professionals included Architects, Builders, Civil engineers, and Quantity surveyors. The bank representatives are the bank managers of each of the selected banks. The questionnaire has three sections. The first section comprises information about the respondents. The second section comprises variables used to assess the level of awareness and implementation of green finance practices among the construction professionals, and bank representatives in Nigeria. The third section consists of factors influencing the level of implementation of green finance practices in green infrastructure development in Nigeria. The data used in the study were collected using a five-point scale of 1 to 5 (Anyanwu, 2018). Scale 1 represents a very low level of awareness/ implementation, while scale 5 represents a very high level of awareness/ implementation of green finance practices among construction professionals, and bank representative in Nigeria. A five-point scale of 1 to 5 was also used to obtain data on the influence of the inhibitors on green finance implementation in green infrastructure development in Nigeria. Scale 1 represents a very low level of influence while scale 5 represents a very high level of influence. Methods of data analysis include descriptive statistics. The simple percentage was used to analyse the respondents' characteristics; while the mean score was used to assess the level of awareness and implementation of green finance practices, as well determine the critical factors influencing the implementation of green finance in

infrastructure development. Using a 5-point scale, the decision rule in this study is that any green finance practice with an overall mean score of 1.0-1.49, 1.5-2.49, 2.5-3.49, 3.5-4.49, and 4.5-5.0 is considered to have a very low level of awareness/ implementation; low level of awareness/ implementation, moderate level of awareness/ implementation, high level of awareness/ implementation; and very high level of awareness/ adoption respectively (Ogenma 2018).

4. PRESENTATION AND DISCUSSION OF RESULTS

4.1. Characteristics of the Respondents

Table 1 shows the result of the analysis of the respondents' characteristics. The result reveals that 80.5% of the construction professionals involved in this study are male, while 19.5% are female. This connotes that the majority of the professionals in this study are male. This also shows the dominance of the male gender in the construction industry. Table 1 also shows that 87.9% of the participants are within the age grade of 20-60 years, while 12.1% of the participants are above 60 years. It implies that majority of the participants in this study are within their active and productive working years. Table 1 shows that 50.5%, 43%, and 6.5% of the participants in this study hold BSc, MSc, and PhD respectively. The result also reveals that all the participants in this study are well educated and knowledgeable enough to give informed and reliable information. Furthermore, the result shows that the participants have good work experience. Therefore, the information obtained from them are adequate for the study and can be relied on.

Table 1. Respondents' characteristics

Respondents' Characteristics	Sub- characteristics	Frequency	Percentage (%)
Gender	Male	247	80.5
	Female	60	19.5
	Total	307	100
Age	20- 60years	270	87.9
	Above 60 years	37	12.1
	Total	307	100
Educational Qualification	B.Sc	155	50.5
	M.Sc	132	43
	PhD	20	6.5
	Total	307	100
Work Experience	5-10	10	3.3
	11-15	35	11.4
	16-20	141	45.9
	20 Years and above	121	39.4
	Total	307	100

4.2. Questionnaire Distribution and Response Rate

Table 2 shows the result of questionnaire distribution and return rate. Four hundred (400) construction professionals, and ten (10) bank representatives were purposively selected, and copies of the questionnaire were distributed by the researchers and research assistants to construction professionals and bank representatives. A total of 307 copies were collected, giving a response rate of 74.9%. This indicates that the response rate is good and adequate. The result is in agreement with Ijosiga and Odubuker (2016), who posited that a response rate of at least 50 % is considered adequate for analysis and reporting, a response of 60 % is good, and a response rate of 70 % is considered to be very good.

Table 2: Questionnaire distribution and response rate

Respondents	Questionnaire Distributed	Questionnaire returned	Response rate (%)
Construction professionals			
Architect	100	75	75
Builder	100	80	80
Civil Engineer	100	70	70
Quantity surveyor	100	72	72
Bank representatives	10	10	100
Total	410	307	74.9

4.3. Level of Awareness of Green Finance Practices

The result in Table 3 shows the level of awareness of green finance practices among construction professionals, and banks' representatives in Nigeria. In line with the decision rule in this study, which states that any green finance practice with an overall mean score (MS) of 1.0-1.49, 1.5-2.49, 2.5-3.49, 3.5-4.49, and 4.5-5.0 is considered to have a very low level of awareness (VLLAW); low level of awareness (LLAW), moderate level of awareness (MLAW), high level of awareness (HLAW); and very high level of awareness (VHLAW) respectively. The result shows that there is very high level of awareness of green mortgage (MS=4.6), carbon finance (MS=4.6), green insurance (MS=4.6), natural disaster bond (MS=4.5), and green bond (MS=4.5) among construction professionals, and bank representative in Nigeria. Furthermore, construction professionals, and bank representatives are highly aware of green home equity loan (MS=4.4), carbon fund (MS=4.4), eco fund (MS=4.3), technology leasing (MS=4.3), and carbon insurance (MS=4.3). Other green finance practices that recorded high level of awareness among the participants in this study include catastrophe insurance (MS=4.2), green fiscal funds (MS=4.0), green auto insurance (MS=4.0), green securitization (MS=3.9), green venture capital and private equity (MS=3.9), green commercial building loan (MS=3.9), green investment funds (MS=3.9), green car loan (MS=3.8), and green credit cards (MS=3.8). Interestingly, there construction professionals, and bank representatives are aware of all the green finance practices assessed in this study. The overall mean score (MS) of 4.2 implies that there is high level of awareness of green finance practices among construction professionals, and bank representatives in Nigeria. This study is in agreement with Vol (2018), who opined that there is increased level of awareness of climate change and environmental sustainability generally, and the need for the financial sector to show commitment toward achieving sustainable development goals.

4.4. Level of Implementation of Green Finance Practices

The result in Table 4 shows the level of implementation green finance practices among construction professionals, and bank representatives in Nigeria. In line with the decision rule in this study, which states that any green finance practice with an overall mean score (MS) of 1.0-1.49, 1.5-2.49, 2.5-3.49, 3.5-4.49, and 4.5-5.0 is considered to have a very low level of implementation (VLLI); low level of implementation (LLI), moderate level of adoption (MLI), high level of implementation (HLI); and very high level of implementation (VHLI) respectively. The result also shows that there is very low level of implementation of green home equity loan (MS=1.2), green commercial building loan (MS=1.2), green car loan (MS=1.3), green credit cards (MS=1.3), carbon insurance (MS=1.4), green venture capital and private equity (MS=1.4), carbon fund (MS=1.4), Green venture capital and private equity (MS=1.4), and Green securitization (MS=1.4).

Table 3: Level of awareness of green finance practices

S.No.	Green finance practices	Architect MS	Builder MS	Civil Engr. MS	Quantity Surveyor	Bank Representatives MS	Overall MS	Rank	Remark
1	Green mortgage	4.5	4.6	4.4	4.5	4.8	4.6	1	VHLA W
2	Green home equity loan	4.4	4.5	4.3	4.1	4.7	4.4	6	HLAW
3	Green commercial building loan	3.8	4.2	3.5	3.4	4.6	3.9	14	HLAW
4	Green car loan	3.5	3.8	3.5	3.6	4.5	3.8	19	HLAW
5	Fiscal fund (treasury fund)	3.7	3.6	3.4	4.2	4.7	3.9	14	HLAW
6	Eco fund	3.8	4.1	4.3	4.5	4.6	4.3	8	HLAW
7	Carbon fund	4.2	4.6	4.1	4.6	4.6	4.4	6	HLAW
8	Natural disaster bond	4.6	4.3	4.4	4.5	4.8	4.5	4	VHLA W
9	Green bond	4.7	4.5	4.6	4.3	4.5	4.5	4	VHLA W
10	Green securitization	3.9	3.5	3.5	3.8	4.6	3.9	14	HLAW
11	Green venture capital and private equity	3.5	3.7	3.6	4.1	4.6	3.9	14	HLAW
12	Technology leasing	4.3	4.2	4.1	4.5	4.4	4.3	8	HLAW
13	Carbon finance	4.8	4.6	4.5	4.6	4.5	4.6	1	VHLA W
14	Green fiscal funds	3.7	3.8	3.5	4.1	4.7	4.0	12	HLAW
15	Green investment funds	3.4	3.6	3.6	4.2	4.6	3.9	14	HLAW
16	Green credit cards	3.2	3.5	3.3	4.4	4.4	3.8	19	HLAW
17	Green auto insurance	4.2	3.6	3.7	3.8	4.7	4.0	12	HLAW
18	Carbon insurance	4.5	3.8	4.2	4.2	4.6	4.3	8	HLAW
19	Catastrophe insurance	3.6	4.2	4.1	4.6	4.5	4.2	11	HLAW
20	Green insurance	4.6	4.5	4.4	4.6	4.8	4.6	1	VHLA W
	Average	4	4.1	4	4.2	4.6	4.2		HLAW

Furthermore, some of the green finance practices recorded low level of implementation by the construction professionals, and bank representatives. These include Green bond (MS=2.2), Green mortgage (MS=1.5), Fiscal fund (treasury fund) (MS=1.5), Eco fund (MS=1.5), Natural disaster bond (MS=1.5), Technology leasing (MS=1.5), Carbon finance (MS=1.5), Green fiscal funds (MS=1.5), Green auto insurance (MS=1.5), Green insurance (MS=1.5), and Catastrophe insurance (MS= 2.5). The overall mean score (MS) of 1.6 implies that there is low level of implementation of green finance practices in infrastructure development in Nigeria. This study is in consonance with Taghizadeh-Hesary, Zakari, Alvarado, and Tawiah (2022) who posited that green finance implementation is at the early stage in Africa. The result of this study is also in tandem with Shan, Hwang, and Zhu (2017) who argued that implementation of green finance in infrastructure development is below expectation.

Table 4: Level of implementation of green finance practices

S.No.	Green finance practices	Architect M.S	Builder M.S	Civil Engr. M.S	Quantity Surveyor M.S	Bank Representatives M.S	Overall MS	Rank	Remark
1	Green mortgage	1.1	1.2	1.4	1.3	2.4	1.5	3	LLI
2	Green home equity loan	1.4	1.1	1.2	1.2	1.2	1.2	19	VLLI
3	Green commercial building loan	1.3	1.2	1.2	1.1	1.4	1.2	19	VLLI
4	Green car loan	1.2	1.3	1.4	1.1	1.3	1.3	17	VLLI
5	Fiscal fund (treasury fund)	1.4	1.2	1.1	1.3	2.4	1.5	3	LLI
6	Eco fund	1.2	1.2	1.3	1.2	2.4	1.5	3	LLI
7	Carbon fund	1.4	1.1	1.1	1.3	2.3	1.4	12	VLLI
8	Natural disaster bond	1.2	1.3	1.3	1.2	2.3	1.5	3	LLI
9	Green bond	2.3	2.1	2.2	2.1	2.4	2.2	2	LLI
10	Green securitization	1.3	1.3	1.2	1.1	2.3	1.4	12	VLLI
11	Green venture capital and private equity	1.2	1.1	1.3	1.4	2.2	1.4	12	VLLI
12	Technology leasing	1.4	1.2	1.4	1.2	2.1	1.5	3	LLI
13	Carbon finance	1.1	1.3	1.3	1.2	2.4	1.5	3	LLI
14	Green fiscal funds	1.2	1.4	1.3	1.4	2.2	1.5	3	LLI
15	Green investment funds	1.3	1.1	1.2	1.1	2.1	1.4	12	VLLI
16	Green credit cards	1.4	1.3	1.4	1.3	1.2	1.3	17	VLLI
17	Green auto insurance	1.5	1.6	1.5	1.6	1.5	1.5	3	LLI
18	Carbon insurance	1.3	1.2	1.1	1.2	2.4	1.4	12	VLLI
19	Catastrophe insurance	2.3	2.5	2.4	2.5	2.6	2.5	1	LLI
20	Green insurance	1.4	1.2	1.3	1.2	2.4	1.5	3	LLI
	Average	1.5	1.4	1.4	1.4	2.1	1.6		LLI

4.5. Factors influencing implementation of green finance practices

Table 5 shows that perceived high risk and low return on investment (MS= 4.8), fear of higher investment costs (MS= 4.7), weak financing structure (MS= 4.5), and investors' lack of in-house capacities to assess greenness of bonds (MS= 4.5) are the critical factors that inhibit the implementation of green finance practices in green infrastructural development in Nigeria. Other barriers that highly inhibit the implementation green finance in green infrastructural development in Nigeria are capital constraint (MS= 4.4), lack of investor incentives (MS= 4.4), financial institutions incapability (MS= 4.3), exorbitant cost of issuance (MS= 4.1), poor institutional quality (MS= 3.9), immature bond market (MS= 3.7), lack of harmonized system (MS= 3.6), lack of green bond supply (MS= 3.5), and under appreciation for bond potentials (MS= 3.5). However, risk of greenwashing (MS= 3.2), lack of clarity on what constitutes green finance activities (MS= 3.0), high inflation (MS= 2.9), and green bonds lack clear pricing advantages compared to regular bonds (MS= 2.7) were considered to have moderate influence on the level of implementation of green finance in green infrastructural development. This study is in agreement with Mustaffa, Ahmad, and Bahrudin (2021) who opined that high risk and low return on investment is a critical factor inhibiting green infrastructural development in developed and developing countries. It is also in consonance with Ametepey, Aigbavboa, and Ansah (2015) who posited that fear of higher investment costs, and capital constraint are critical factors affecting green finance in infrastructural development.

Table 5: Factors influencing implementation of green finance practices

S.No.	Factors influencing implementation green finance practices	Construction professionals M.S	Banks' Representatives M.S	Overall MS	Rank
1	Fear of higher investment costs	4.6	4.7	4.7	2
2	Financial institutions incapability	4.1	4.4	4.3	7
3	Capital constraint	4.2	4.6	4.4	5
4	Weak financing structure	4.5	4.4	4.5	3
5	Perceived high risk and low return on investment	4.8	4.8	4.8	1
6	Lack of clarity on what constitutes green finance activities	3.1	3.0	3.0	15
7	Green bonds lack clear pricing advantages compared to regular bonds	2.8	2.6	2.7	17
8	Investors lack in-house capacities to assess greenness of bonds	4.5	4.5	4.5	3
9	Lack of investor incentives	4.3	4.4	4.4	5
10	High inflation	3.3	2.6	2.9	16
11	Poor institutional quality	4.2	3.6	3.9	9
12	Immature bond market	3.5	3.9	3.7	10
13	Lack of harmonized system	3.7	3.5	3.6	11
14	Risk of greenwashing	3.2	3.1	3.2	14
15	Exorbitant cost of issuance	4.2	4.1	4.1	8
16	Lack of green bond supply	3.6	3.3	3.5	12
17	Under appreciation for bond potentials	3.8	3.2	3.5	12

5. CONCLUSIONS AND RECOMMENDATIONS

The study evaluated the level of awareness and implementation of green finance practices among construction professionals, and financial institutions in Nigeria. Critical inhibitors to green finance implementation in green infrastructural development were also assessed. The study reveals a response rate of 74.8%. Hence, the response rate is adequate for the study. The result showed that there is high level of awareness of green finance practices among construction professionals and bank representatives in Nigeria. The study also showed that there is low level of implementation of green finance practices in infrastructure development in Nigeria. This study established that the level of awareness of green finance practices is high, one would anticipate a matching high level of adoption of green finance practices. However, the level of adoption of green finance practices is at a low stage. Therefore, this study concluded that high level of awareness does not lead to matching high level of adoption of green finance practices.

The study also concluded that perceived high risk and low return on investment, fear of higher investment costs, weak financing structure, investors' lack of in-house capacities to assess greenness of bonds, capital constraint, lack of investor incentives, financial institutions incapability are the critical factors inhibiting the implementation of green finance practices in green infrastructural development in Nigeria. Based on the findings, this study recommended that construction professionals operating in Nigerian built environment, and Nigerian banks should build their capacities towards meeting sustainable development goals. It is also recommended that incentives should be given to investors who want to develop green infrastructure.

REFERENCES

- Adewuyi, T. O., and Otali, M. (2013). Evaluation of causes of construction material waste: Case of Rivers State, Nigeria. *Ethiopian Journal of Environmental Studies and Management*, 6(Supplement), 746{753. [Http://dx.doi.org/10.4314/ejesm.v6i6.5S](http://dx.doi.org/10.4314/ejesm.v6i6.5S)
- Adewuyi, T. O., and Ujene, A. O. (2019). Impact of procurement methods on material waste in low - rise building projects in Nigeria. *International Journal of Architecture, Engineering and Construction*, 8(2), 44{53.<http://dx.doi.org/10.7492/IJAEC.2019.010>
- Ametepey, O., Aigbavboa, C. and Ansah, K. (2015). Barriers to successful implementation of sustainable construction in the Ghanaian construction industry, 6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015, Procedia Manufacturing 3 (2015) 1682 – 1689
- Amuakwa-Mensah, F., Klege, R.A., Adom, P.K., Amoah, A. and Hagan, E. (2018). “Unveiling the energy saving role of banking performance in Sub-Sahara Africa”, *Energy Economics*, Vol. 74, pp. 828-842.
- Amundi and IFC (2018). Emerging market Green Bonds report 2018: A consolidation year paving the way for growth.
- Ahn, Y. H., Jung, C. W. Suh, M., and Jeon, M. H. (2016). Integrated construction process for green building. *Procedia Engineering*, 145, 670{676. <https://doi.org/10.1016/j.proeng.2016.04.065>
- Anyanwu, C.G. (2018). Constraints to adoption and utilization of cassava production technologies among farmers in Imo State, Nigeria. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 18 (1), 67{72.
- Banga, J. (2019). The green bond market: A potential source of climate finance for developing countries. *Journal of Sustainable Finance & Investment*, 9(1), 17–32.<https://doi.org/10.1080/20430795.2018.1498617>
- Benhida, J. and Mounsif, Y. (2019). Green bonds in Morocco: The regulator’s perspective. SBN Green Bond Working Group, IFC Sustainability Webinar Series, February. www.ifc.org/sustainabilitywebinars
- Beschloss, A. and Mashayekhi, M. (2019). A greener future for finance: Green bonds offer lessons for sustainable finance. *Finance & Development*, 60–61.
- CBI (2019). Green bonds: The state of the market 2018. Climate bonds initiative. https://www.climatebonds.net/files/reports/cbi_gbm_final_032019_web.pdf
- Connolly-Boutin, L. and Smit, B. (2016), “Climate change, food security, and livelihoods in sub-Saharan Africa”, *Regional Environmental Change*, Vol. 16 No. 2, pp. 385-399, doi: 10.1007/s10113-015-0761-x.
- Dalibi, S. G., Feng, J. C., Abubakar, S. G., Kumo, H. A., Danja, I. I., Mukhtar, A. A. and Inuwa, L. U. (2020). Socio-economic performances of mega construction projects (mcps) in the light of sustainable development of Nigeria’s built environment, *IOP Conf. Ser. Earth Environ. Sci.*, vol. 495, no. 1, 2020, doi: 10.1088/1755-1315/495/1/012046.
- Dania, A. A, Larsen, G. D., and Yao, R. (2013). Main streaming sustainable construction: Case studies of an indigenous and multinational firm in Nigeria. *Proceedings of the Engineering Project Organization Conference*, Colorado, USA.
- Deschryver, P. and De Mariz, F. (2020), “What future for the green bond market? How can policymakers, companies, and investors unlock the potential of the green bond market?”, *Journal of Risk and Financial Management*, 13, 3, 61.
- Duru, U. and Nyong, A. (2016). Why Africa needs green bonds. *Africa Economic Brief*, AEB, 7(2), 1–7. African Development Bank, Abidjan, Cote d’Ivoire.
- Esezobor, E. L. (2016). Sustainability and construction: A study of the transition to sustainable construction practices in Nigeria. PhD thesis, Birmingham City University, UK.

- Falcone, P. M. (2020). Environmental regulation and green investments: The role of green finance. *International Journal of Green Economics*, 14(2), 159-173.
- Gaspar, V., Amaglobeli D., Garcia-Escribano, M., Prady D., and Soto, M. (2019). Fiscal policy and development: Human, social, and physical investment for the SDGs. IMF Staff Discussion Note, SDN/19/03.
- Ghahroudi, M.L., Rezaei, S., Oryani, B. and Tajdini, S.(2020) . Types of green financial products in developing countries, *Journal of Economics and Environment*, 1, 1, 2020,: 10- , [https://doi.org/10.47277/JEE/1\(3\)8](https://doi.org/10.47277/JEE/1(3)8)
- Goel, P. (2016). Green Finance: A step towards sustainable financial system. *Abhinav International Monthly Refereed Journal of Research in Management & Technology*, 5(5), 22-31
- Guild, J. (2020). The political and institutional constraints on green finance in Indonesia. *Journal of Sustainable Finance & Investment*, 10(2), 157-170.
- Hafner, S., Jones, A., , Anger-Kraavi, A., , & Pohl, J. (2020). Closing the green finance gap—A systems perspective. *Environmental Innovation and Societal Transitions*. 34, 26-60.
- Heravi, G., Fathi, M., and Faeghi, S. (2015). Evaluation of sustainability indicators of industrial buildings focused on petrochemical projects. *Journal of Cleaner Production*, 109, 92{107. <http://dx.doi.org/10.1016/j.jclepro.2015.06.133>
- Hong Kong Financial Services Development Council(2016).. Hong Kong as a Regional Green Finance Hub; Hong Kong Financial Services Development Council: Wanchai, Hong Kong, 2016.
- IFC (2019). Green bond impact report, 2019. IFC, Washington, DC, USA. International Capital Markets Association (ICMA)(2019), “The green bond principles” <www.icmagroup.org> accessed 22 February 2019.
- Jackson, E. N., Mustapha, Z., and Kotey, S. (2019). Compressive strength of concrete produced with proportions of coconut and palm kernel shells. *International Journal of Architecture, Engineering and Construction*, 8(1), 35{41. <http://dx.doi.org/10.7492/IJAEC.2019.004>
- Jha, B. and Bakhshi ,P.(2019) . Green Finance: Fostering sustainable development in India, *International Journal of Recent Technology and Engineering (IJRTE)* ISSN: 2277-3878, 8(4) 3798-3801
- Kemfert, C., Dorothea, S., and Willi, S. (2020). Great green transition and finance. *Intereconomics* 55, 181-186.
- Li, Y., Duan, X., and Zhao, J. (2018). Review on construction and demolition waste for potential research trends. *International Journal of Architecture, Engineering and Construction*, 7(3), 1{13. <http://dx.doi.org/10.7492/IJAEC.2018.013>
- Lindenberg, N. (2014). Public instruments to leverage private capital for green investments in developing countries. German Development Institute/Deutsches Institut für Entwicklungspolitik (DIE) Discussion Paper, 4.
- LSEG Africa Advisory Group (2018). Developing the green bond market in Africa. London Stock Exchange Group, London, England.
- Mahat, T., J. B., Uperty, B., and Bittner, M. (2019). Climate finance and green growth: reconsidering climate-related institutions, investments, and priorities in Nepal. *Environmental Sciences Europe*, 31(1), 46.
- Marcelo, C.; Daniel, P. (2013).Green performs better: Energy efficiency and financial return on buildings. *J. Corp.Real Estate* 2013, 15, 53–72.
- Mohd., S and Kaushal, V.K.(2018). Green Finance: A Step towards sustainable development. *Journal of Finance and Accounting*, 5,(1), Jan-Jun 2018, 59-74 doi: 10.17492/mudra.v5i01.13036
- Muhammad, Z., Saputra, J., Hashim, N., and Mohd Nor, M.(2019). *A study of green management practice for reducing annual budget and protecting the environment*. Proceedings of the 33rd International Business Information Management Association Conference, IBIMA 2019: Education Excellence and Innovation Management through Vision 2020, 573-58.

- Muller, C., Waha, K., Bondeau, A. and Heinke, J. (2014). Hotspots of climate change impacts in sub-Saharan Africa and implications for adaptation and development", *Global Change Biology*, Vol. 20 No. 8, pp. 2505-2517, doi: 10.1111/gcb.12586
- Mustaffa, A.H., Ahmad, N. and Bahrudin, N. Z. (2021). A Systematic literature review on barriers to green financing participation worldwide, *Global Business and Management Research: An International Journal* , 13(4), 66-79
- National Bureau of Statistics (2018a). Nigerian gross domestic product report, February 2018, Abuja, Nigeria.
- National Bureau of Statistics (2018b). Nigerian gross domestic product report, August 2018, Abuja, Nigeria.
- Nigerian Stock Exchange(2018) *Green bonds* <<https://www.nse.gov.ng/>> accessed 15 December 2018.
- Obine, N.I. (2020). Green bonds: A catalyst for sustainable development in Nigeria. In: W. Leal Filho (eds) *Handbook of Climate Change Resilience* Springer, Cham pp. 1859–1882. https://doi.org/10.1007/978-3-319-71025-9_106-1
- Oche, A. (2020). Comparative analysis of green bond regimes in Nigeria and China, *Journal of Sustainable Development Law and Policy*, 11(1), 161-184. DOI: [https://Dx.Doi.Org/10.4314/Jsdlp.V11i2.8](https://dx.doi.org/10.4314/jsdlp.v11i2.8)
- Ogenma, U. (2018). Home background and disciplinary problems among senior secondary school students in Ahoada East local government area of Rivers State. *International Journal of Scientific Research in Education*, 11(6), 1059{1085.
- Olivia, S., Adams, S., Baarsch, F., Coumou, D., Robinson, A., Hare, W. and Reinhardt, J. (2017). Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions", *Regional Environmental Change*, 17 (6), pp. 1585-1600.
- Omuh, I., Ojelabi, R., Tunji-Olayeni, P., Afolabi, A., Amusan, L., and Okanlawon, B. (2018). Green building technology design and adoption: Occupants perspective. *International Journal of Mechanical Engineering and Technology*, 9(8), 1345{1352.
- Price Waterhouse Coopers Consultants (PWC) (2013). Exploring green finance incentives in China. Retrieved from <https://www.pwchk.com/en/migration/pdf/green-finance-incentives-oct2013-eng.pdf>
- Raghupati, M. and Sujhatha, S. (2015). Green banking initiatives of commercial banks in India. *International Research Journal of Business and Management*, 8(2), 74-81.
- Rozenberg, J. and Fay, M. (2019). Beyond the gap: How countries can afford the infrastructure they need while protecting the planet. *Sustainable Infrastructure*. Washington, DC: World Bank. World Bank. [https:// openknowledge.worldbank.org/handle/10986/31291](https://openknowledge.worldbank.org/handle/10986/31291)
- Schumacher, K., Chenet, H, and Volz, U. (2020). Sustainable finance in Japan, *Journal of Sustainable Finance & Investment*, 10(2), 213-246.
- Shan, M, Hwang, B and Zhu, L. (2017). A global review of sustainable construction project financing: policies, practices, and research efforts, *Sustainability* , 9, 2347; doi:10.3390/su9122347
- Sirkeck, S. (2017). Application of Green Construction Technology in Construction Projects: MSc thesis, Jaypee University of Information Technology, Himachal Pradesh, India.
- Soundarrajan, P.; Vivek, N. (2016). Green finance for sustainable green economic growth in India. *Agric. Econ. (Zemed. Ekon.)* 2016, 62, 35–44.
- Swarnkar, D. K., and Singh, S. (2016). Investigating the green technology function in construction perspective, *International Journal of Engineering Research and Management Technology*, 3(1), 144{148.
- Taghizadeh-Hesary, F., Zakari, A., Alvarado, F., and Tawiah, V. (2022). The green bond market and its use for energy efficiency finance in Africa, *China Finance Review International*, DOI: 10.1108/CFRI-12-2021-0225

- Tolliver, C., Keeley, A. R., and Managi, S. (2020). Drivers of green bond market growth: The importance of Nationally Determined Contributions to the Paris Agreement and implications for sustainability. *Journal of Cleaner Production*, 244.
- Tu, C.A. and Rasoulinezhad, E. (2021). Energy efficiency financing and the role of green bond: policies for post-Covid period”, *China Finance Review International*, Vol. ahead-of-print No. ahead-of-print, doi: 10.1108/CFRI-03-2021-0052.
- United Nations Environment Programme Finance Initiative (UNEP FI) (2014). Demystifying private climate finance. <https://www.unepfi.org/fileadmin/documents/DemystifyingPrivateClimateFinance>
- UNEP Inquiry (2016). Green finance and non-G20 developing countries: needs, concerns, aspirations and approaches. Briefing.
- Volz, U. (2018). Fostering Green Finance for Sustainable Development in Asia. ADBI Working Paper 814. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/fostering-green-finance-sustainable-development-asia>
- Volz, U., J. Böhnke, V. Eidt, L., Knierim, K., Richert, G., Roeber, M. (2015): *Financing the Green Transformation – How to Make Green Finance Work in Indonesia*, Houndmills, Basingstoke: Palgrave Macmillan.
- Wang, Y., and Zhi, Q. (2016). The role of green finance in environmental protection: Two aspects of market mechanism and policies. *Energy Procedia*, 104, 311 – 316
- Windapo, A. O. (2014). Examination of green building drivers in the South African construction industry: Economics versus ecology. *Sustainability*, 6, 6088{6106, <https://doi.org/10.3390/su6096088>
- World Bank (2019). The World Bank Green Bond Impact Report 2019. World Bank, Washington DC, USA
- Zhang, X., Wu, Y., Shen, L., and Skitmore, M. (2014). A prototype system dynamic model for assessing the sustainability of construction projects. *International Journal of Project Management*, 32(1), 66{76. <https://doi.org/10.1016/j.ijproman.2013.01.009>