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## **Exploring the Viability of Shipping Container Housing as a Solution to Student Accommodation Deficit in Nigeria**

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Master Thesis

International Master of Science in Construction and Real  
Estate Management

Joint Study Program of Metropolia UAS and HTW-Berlin

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**International Master of Science in construction and Real Estate Management**  
**Joint study programme of Metropolia UAS Helsinki and HTW Berlin**

**Date: 22.6.2022**

**Conceptual formulation**

**Master Thesis for: Mr. Ifeanyi Okeoma**

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Topic:

**THE USE OF SHIPPING CONTAINER HOUSING TO TACKLE STUDENT  
ACCOMMODATION CHALLENGE IN TERTIARY INSTITUTIONS IN NIGERIA.**

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## 1.0 Introduction

Nigeria is projected to become the third-largest country in the world by 2050, with 399 million people, according to the United Nations, and there exist a teeming population within the bracket of low to zero income earners who are living a poor standard life due to the inability of the government to provide adequate housing and other amenities. In many third-world countries, poor living conditions, fast depleting national economies, and insufficient amenities for low- and no-income earners are some of the causes exacerbating the situation. (United Nations, 2015).

Population increase is also felt in tertiary institutions, in 1948, University College- Ibadan opened its doors to 104 students, both male and female, as Nigeria's first university campus. These 104 pioneering students were provided with on-campus housing. As of 2019, 1.961 million students registered in Nigeria's universities, representing 1.89 million percent of the country's 1948 population; the number of universities in Nigeria has grown from one to 164, with over 75 private institutions and 47 public colleges constructed across the 36 states. (Adedigba, 2018.).

In his study, Umoh (2012) noted that the role of government in housing provision has been primarily policy formulation and not actual housing provision. It is the same story at universities, where over 70 - 80 percent of tertiary students live in private residences (Zubairu, 2018). This is a clear indication that a potential market exists for investors willing to venture into real estate that caters for student accommodation.

Furthermore, Developers believe that investing in student housing under BOT is worthwhile, also, Developers are interested in participating in the BOT for Student Housing according to the survey (Ibrahim et al., 2018).

Shipping container housing has been seen to be economically viable, easy to construct or assemble and saves time, it also ties into sustainability by embracing the concept of circular economy.

According to Ijaiye-Oladapo (2019), an industry specialist in cargotechture, raising awareness about the possibilities and benefits of cargotechture has resulted in widespread acceptance of the shipping container house concept. The demand for modular construction structures has



increased dramatically during the last four years. The technology is 25% less expensive than convectional structures and allows for faster construction.

Site clearing and preparation, foundation, installation of walls, roofing, and finishes are all steps in the construction of a home. However, the construction of shipping container homes tends to skip some of the stages, resulting in cost and time savings. (Abiodun Balogun, 2018).

They're also suitable for either temporary or permanent use. They're also thought to be easy to design and build, as well as aesthetically beautiful.

Modular building construction using shipping containers are practicable in cold temperate region and has not been widely used in the hot and humid region, although the limitations of this architectural options in the hot regions can be overcome by the advantages. (Onuorah, 2020).

Thousands of shipping containers are discarded every year; hence this gives credence to being socially responsible and environmentally conscious when shipping containers are rescued from the junkyard and converts them to a home. Furthermore, it ties to sustainable production and consumption goal of the United Nations which translates to saving money and making good use of waste material for home construction. The United Nations Brundtland Commission in the year 1987 defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs"(Cebrián et al., 2009).

This thesis sets out to investigate the possibility and viability of real estate developers venturing into students housing accommodation by constructing modular structures with the use of shipping containers.

## **2.0 Research Focus and Questions.**

This thesis will focus on real estate developers in Nigeria, it will border around the cost benefit analysis of using shipping containers for student accommodation in tertiary institutions in Nigeria, considering the huge deficit in students accommodation as recorded by AbdulAzeez, et al., (2015) they asserted that in Nigeria, just a few institutions can accept up to 50% of their student population in terms of accommodation, and other universities have a 90% gap. In achieving the objectives of this thesis, the following questions will require insight from the respondents:

Questions:

1. In terms of sustainability, what are the underlying benefits of using a shipping container home for student accommodation?
2. What is the level of acceptability among student regarding shipping container housing for accommodation purpose?
3. How would one evaluate the hidden costs like maintenance and risk liabilities regarding structural integrity especially during the lifecycle of shipping container housing when used for student accommodation?
4. How well does the use of shipping container housing for student accommodation purpose embrace the concept of sustainable production and consumption?

### 3.0 Methodology

The area under review will be Nigeria, and sample location will be Abuja-the federal capital territory where the use of shipping container housing is gaining appreciation in the recent times. Data will be gotten from different sources:

1. Extensive review of secondary sources of information such as journals, research papers and articles.
2. Questionnaire survey of professionals in the construction and real estate industry, such as architects, engineers, academics, and construction firms in general.

### 3.1 Expected Research Outcome

The expected outcome of this research will be a clarification on the feasibility of using shipping container housing for student accommodation after carrying out an extensive cost benefit analysis. This will be done by comparing two or more options of building models and proposing areas where modular building (Shipping container housing) reveals the most benefit.

### 3.2 Estimated duration

The estimated completion period for this research work will be around 7 months

S/No	Task Name	Resource	Duration	Start date	Finish Date
1	Conceptual formulation	Relevant Journals, seminar proceedings, reports, and published thesis	18 weeks	10 January 2022	6 <sup>th</sup> May 2022

2	Literature review	Relevant Journals, seminar proceedings, reports, and published thesis	18 weeks	7 <sup>th</sup> May 2022	10 <sup>th</sup> September 2022
3	Formulation of Questionnaire		8 weeks	12 <sup>th</sup> September 2022	4 <sup>th</sup> November 2022
4	Questionnaire Distribution and collection	Through mails	14 weeks	7 <sup>th</sup> November 2022	24 <sup>th</sup> February 2023
5	Data Analysis and Result Interpretation	Use of Data analysis software SPSS	5 weeks	27 <sup>th</sup> February 2023	23 <sup>rd</sup> April 2023
6	Final Defence/ Oral Examination		4 weeks	June 2022	June 2022

### 3.4 Possible challenges

The possible challenges envisaged during this research would be

- 1 Delay in collating the questionnaires from respondents.
- 2 No response from respondents/ invalid responses.

### 3.5 Resources

The resources to be used during this research would be

1. Library sources will include recent thesis, journals, conference proceedings and seminar reports.
2. The use of SPSS (Statistical Package for Social Scientist).

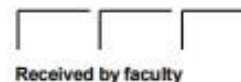


### References:

- AbdulAzeez, A Dauda, Abdulhafeez, Ibrahim and Kado, Dikko (2015) "An Investigation into challenges of build operate transfer hostel provision in Nigerian tertiary institutions" *Journal of Nigerian Institute of Building*, 6(1):17-28.
- Abiodun, Balogun L. (2018). *Shipping Container as an Alternative Housing Solution*. May. [http://www.theseus.fi/bitstream/handle/10024/149465/Balogun\\_Lukmon\\_Abiodun.pdf?sequence=1&isAllowed=y](http://www.theseus.fi/bitstream/handle/10024/149465/Balogun_Lukmon_Abiodun.pdf?sequence=1&isAllowed=y)
- Adelowokan, Sogo. (2018). Private sector participation in students housing delivery in public universities of southwestern Nigeria.
- Cebrián, G., Junyent, M., Hancock, L., Nuttman, S., Dunn, K. E., Mulvenon, S. W., Jansen, I. J. L. A., Sammalisto, K., Lindhqvist, T., Martin, S., Africa, S., Cebrián, G., O'Byrne, D., Dripps, W., Nicholas, K. A., Higher, E., Future, U. L. for a S., Attaran, S., Celik, B. G.,
- Hilser, S. (2009). Sustainability Assessment Questionnaire (SAQ) for Colleges and Universities. *Innovative Higher Education*, 3(4), 221–233. [http://eprints.uwe.ac.uk/11735/0Ahttp://dx.doi.org/10.1080/13504622.2016.1217395%0Ahttp://ezproxy.library.yorku.ca/login?url=http://search.proquest.com/docview/224676451?accountid=15182%5Cnhttp://sfx.scholarsportal.info/york?url\\_ver=Z39.88-2004&rft\\_val\\_fm](http://eprints.uwe.ac.uk/11735/0Ahttp://dx.doi.org/10.1080/13504622.2016.1217395%0Ahttp://ezproxy.library.yorku.ca/login?url=http://search.proquest.com/docview/224676451?accountid=15182%5Cnhttp://sfx.scholarsportal.info/york?url_ver=Z39.88-2004&rft_val_fm)
- Ibrahim, Abdulhafeez., Musonda, Innocent., & Ibrahim, Kabir. (2018). *Challenges of Student Housing Provision through Public Private Partnership*. 1–11.
- Onuorah, Uchechukwu. J. (2020). *Study of Shipping Container Housing As an alternative to sancrete block and reinforced concrete in Lagos: A dissertation submitted to the department of Architecture, Bells University of Technology, Ota January 2020*
- United Nations. 2015. World Population Prospects: The 2015 Revision, accessed February 2017, [https://esa.un.org/unpd/wpp/publications/files/key\\_findings\\_wpp\\_2015.pdf](https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf).
- Umoh, Nseabasi (2012). Exploring the Enabling Approach to Housing through Abuja Mass Housing Scheme: A master thesis submitted to the Department of Urban Studies and Planning Massachusetts institute of technology, June 2012.



For the  
Chairperson of the Examination Board



of the **Programme** \_\_\_\_\_  
at the Hochschule für Technik und Wirtschaft Berlin

## REQUEST TO CHANGE THE TITLE OF THE FINAL THESIS

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I wish to request for the following change to the title of my thesis.

**Previous title:**

The Use of Shipping Container Housing to Tackle Student  
Accommodation Challenges in Tertiary Institutions in Nigeria

**New title to be confirmed:**

Exploring The Viability of Shipping Container Housing as a Solution to  
Student Accommodation Deficit in Nigeria

Please note that changing the title of the final thesis does not constitute a rejection of the topic as defined by § 21, no. 2 of HTW's Examination Framework Regulations!

**Agreement** of the 1st examiner:

*Paula Naukkarinen*

**Agreement** of the 2nd examiner:

*Zsuzsa Besenyői*

**Agreement of the examination board:**

Berlin, 20/06/2023

  
Signature of the candidate

## **Abstract**

Shipping containers have transformed from being mere cargo carriers to being utilized as eco-friendly, innovative and sustainable homes. This study explores the paradigm shift of shipping container housing, investigating its architectural ingenuity, environmental sustainability, and potential to address the pressing challenges of student accommodation deficit in a dynamic world. This study explores factors influencing students' acceptance of shipping container housing as an option. The research examines the economic viability of container housing and stakeholder interests. By examining the existing situation of student housing at Nigerian universities, the thesis determines if container housing is feasible and has the potential to serve as a long-term solution to the housing dilemma. The research assesses the social, economic, and environmental implications of container dwelling using the idea of sustainable development as a framework. This study explores factors influencing students' acceptance of shipping containers as a housing option. It evaluates economic feasibility and sustainability, focusing on student housing in Nigerian universities. A combination of methodologies, including questionnaires and a literature review, were used in the study. Students are aware of container housing and think of it as a workable solution, according to the research. Due to its sustainability and potential for speedy construction, container housing has drawn the attention of interested parties like developers and stakeholders. The study focuses on waste management, energy efficiency, and water conservation as crucial components of sustainable container housing. The study comes to the conclusion that the student housing issue in Nigeria can be effectively solved by container housing. Container housing is a practical alternative due to its quick construction, simplicity of transportation, and possibility for sustainable practices. Through its analysis of student acceptance, financial viability, and the environmental effects of container housing, this study will Nigeria handle the problem of a lack of student accommodation.

**Keywords:** Sustainable development, Nigeria, student accommodation, shipping container housing.

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**List of Abbreviations**

COR-TEN .....	Corrosion-resistant construction steel
FUTA .....	Federal University of Technology Akure
Fig. ....	Figure.
MIS .....	Mean Item score
MDGs .....	Millennium Development Goals
SDGs.....	Sustainable Development Goals
UN .....	United Nations
RQ.....	Research Questions

**List of Symbols**

$\sum fx+$  The weight given to each attribute by the respondents.

$\sum f$  Total number of respondents in the sample.

$K$  The highest weight on the *likert* scale

$F$  Frequency of responses to each rating (1-5) for each variable

$S$  Score given to each variable by respondent on a scale of 1 to 5

$N$  Total number of responses related to the factor.

## Chapter 1: General Introduction

### 1.1 Introduction

Globally, student housing is very important since many educational institutions find it difficult to provide their students with sufficient housing. Students' quality of life and academic performance are negatively impacted by a problem caused by the rising student population and the housing shortage (Duyilemi, 2022). The lack of adequate housing for students is an issue in first- and third-world nations. Some students in the United States, for instance, must choose between paying for housing and paying tuition because of the rising expense of both (Ceylan, 2022). Students in the United Kingdom are vulnerable to exploitation by shady landlords due to a lack of cheap housing options caused by the ongoing housing crisis.

Many overseas students in Australia are compelled to live in overcrowded, inadequate conditions because they cannot afford better accommodations. The crisis is significantly more severe in emerging nations (Samson et al., 2022). Universities in Nigeria, for example, are dealing with a serious housing problem that has left many students in deplorable circumstances. The rising tide of college-bound individuals and the scarcity of reasonably priced accommodation worsen the situation (Duyilemi, 2022). Furthermore, many students are burdened by lengthy commutes, which can negatively affect their health and productivity in the classroom.

In Nigeria, there has been an upsurge in the last few years in the need for inexpensive housing. Tertiary institutions continue providing housing using conventional methods and traditional materials, thus experiencing the effects of student population growth. According to Ceylan (2020), there are currently 1.961 million students enrolled in Nigeria's higher education institutions, equivalent to a multifold increase in the student population since 2010. The number of colleges and universities in Nigeria has increased significantly to 164, and over 75 private institutions and 47 community colleges are available across all 36 states (Osazuwa et al., 2021). Because of the government and private enterprises' cost, time, and delivery capabilities, traditional building construction cannot significantly reduce the housing shortfall in Nigeria. However, the Freight container-based construction method is an economic concept embraced globally and is trusted to solve the housing problem (Osazuwa et al., 2021). Despite the horrible condition of Nigeria's housing, this remedy is easily accessible but rarely used.

Many studies have shown that this method can be used in regions similar to Lagos if properly constructed. Many typical studies in Nigeria focus on the long-term viability of shipping container homes from various perspectives (Osazuwa et al., 2021). The studies also focus on the possibilities for shipping container construction from user convenience and structural soundness perspectives.

## **1.2 Background of the Research**

Student housing is a worldwide issue that has plagued both developed and developing nations for decades. According to Samson et al. (2022) There is a problem affecting students' quality of life and academic performance as a direct consequence of the rising number of students enrolling in higher institutions and the restricted supply of accommodation. The high cost of developing and maintaining dormitories has made traditional construction approaches ineffective in resolving this issue for many organizations (Olanrewaju et al., 2022). As a result, innovative approaches like container homes have gained traction in recent years.

The level of acceptance among students is one of the biggest obstacles to container housing. Converted shipping containers have a bad reputation among students for being unappealing and claustrophobic. Yet attitudes are shifting as more and more establishments choose container housing as an answer to the housing shortage. For instance, in Fig. 1 and Fig. 2, the University of South Wales students in the United Kingdom now live in brand-new, ultra-convenient container housing units (Olanrewaju et al., 2022). All of the rooms have their own private toilets, kitchenettes, and high-speed internet access. Student approval of container housing is encouraging and can pave the way for its wider use.



**Figure 1:** Container housing units for<sup>1</sup> students in University of South Wales, UK<sup>1</sup>



**Figure 2:** Interior of a student room<sup>2</sup>

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<sup>1</sup> Discombe 2019

<sup>2</sup> Discombe 2019

Developers, investors, and governments all see great potential in the container housing market. The method reduces the expense of constructing and running hostels, providing a viable long-term solution to the housing shortage (Balogun, 2018). Because of its scalability, organizations can easily install additional container dwellings to meet rising housing demands. The method also has the potential to generate income for the organizations involved through rental fees for the occupied dwellings (Balogun, 2018). Positive signs of the approach's potential for wider implementation include the increased interest and acceptance of container dwelling across stakeholders.

A viable green housing alternative, container dwellings have the potential for excellent energy efficiency. Using used shipping containers for wood and cement, this method decreases its carbon impact (Islam et al., 2016). In addition, the containers can be outfitted with solar panels and insulation to cut down on energy use and expenditures (Islam et al., 2016). Off-grid living is a possibility with container housing since they are equipped to provide their power, water, and sewage systems. Containers are a viable housing choice for organizations that want to promote sustainable lifestyles while minimizing environmental impact.

Institutions that employ container housing can simultaneously protect their history and provide contemporary living quarters for their students, promoting cultural sustainability. Container residences are often designed with cultural identity and sustainability in mind using traditional design features and materials (Adesola, 2019). Moreover, container housing can provide communal living areas that encourage students from diverse cultural backgrounds to get to know one another and share their experiences. Container housing is a great idea since it promotes cultural sustainability, the fourth pillar of sustainability.

The study on container housing for universities in Nigeria cannot be separated from the fourth pillar of sustainability, often known as cultural sustainability. When discussing cultural sustainability, the focus is on promoting and protecting cultural variety, identity, and tradition to ensure that everyone benefits from this (Fritz et al., 2019). The goal of cultural sustainability in container housing is to preserve cultural traditions while encouraging community cohesiveness and fostering a sense of shared identity among residents.

Researchers in Nigeria are looking at how container housing can help with the country's social, economic, and environmental problems in higher education. The strategy, however, also considers the cultural sustainability part of sustainability, which is crucial to the approach's effectiveness and long-term survival (Balogun, 2018). There are many different cultural and ethnic groups in Nigeria, all with their customs and traditions. The design of container homes should include these many cultural features to represent the local community's history and traditions properly (Balogun, 2018). The strategy furthers social equality and justice by adding cultural components into the design of container dwelling units. When students of many ethnic origins feel accepted, they flourish emotionally and intellectually (Balogun, 2018). Housing units that reflect the local community's cultural identity and history help guarantee that this strategy serves the local community.

The social, economic, and environmental issues educational institutions face are all made more manageable by container housing. Institutions that want to encourage eco-friendly lifestyles should consider this method because of its rising popularity among students and other stakeholders and its potential for energy efficiency and cultural longevity.

### **1.3 Problem Statement**

The issue of insufficient and inappropriate student accommodation in Nigeria is a serious difficulty that impacts the academic performance, safety, and well-being of tertiary institution students. The present housing situation is characterized by congestion, lack of basic utilities, and bad living circumstances, resulting in student unhappiness and low academic performance (Adama et al., 2018). The lack of acceptable accommodation alternatives also prevents overseas students from studying in Nigeria, significantly damaging the country's economy.

The Nigerian government and private sector have launched several attempts to alleviate the housing issue, including creating student dormitories and off-campus residences. Unfortunately, these initiatives have not properly addressed the problem, and many students still struggle to locate acceptable housing choices. One proposed answer to the student housing crisis in Nigeria is container housing. Container housing includes shipping containers to produce economical and sustainable dwelling units



(Balogun, 2018). This method has proven effective in other nations, such as the United States and South Africa, where container housing has given students safe and adequate living alternatives.

Nevertheless, the viability of container housing in Nigeria would rely on students' approval of the idea. Numerous elements, including the design and quality of the housing units, safety and security, availability of facilities, and cultural compatibility, will impact students' approval of container living (Adama et al., 2018). Consequently, the fundamental objective of this research project is to analyze how the issue of insufficient student housing in Nigeria might be remedied while concentrating on student acceptance. The study will explore the elements that determine student acceptance of container living and provide methods to resolve any concerns or difficulties expressed by students. The research will also investigate the economic feasibility of container housing, stakeholders' interests, and the environmental effect of the method.

The ultimate purpose of this study is to propose a realistic and lasting solution to the student housing issue in Nigeria that is acceptable to students and other stakeholders. By addressing the problem of student acceptance, the research will contribute to the success and long-term feasibility of the container housing method in Nigeria.

#### **1.4 Aim and Scope of the Study**

This study aims to investigate the viability of container housing as a potential solution to the student housing shortage affecting Nigerian universities. To accomplish this goal, the research will focus on analyzing the existing situation of student housing in Nigerian universities and the difficulties that students and universities in the country face.

The research will look at the environmental, social, and economic impacts of container housing and evaluate how well-received it is by academic institutions and students. Cultural sustainability in container homes will also be investigated, emphasizing infusing regional aesthetics into the built environment.

Investors, real estate developers, and government organizations are among groups that will be named in the research study investigating the deployment of container housing. This study will analyze the possible income sources and the costs associated with constructing and maintaining the dwelling units made from shipping containers.

The research will also examine container housing's scalability or how easily new units can be added to meet rising demand. The study aims to shed light on the possibilities of container housing as a solution to Nigeria's students' housing shortage.

The study's scope includes an evaluation of the current state of student housing in Nigerian tertiary institutions, the viability of container housing as a solution to the accommodation crisis, the acceptability of the idea among stakeholders, the potential for cultural sustainability, the identification of stakeholders, the cost implications, and the scalability of the approach, among other things.

### **1.5 Research Questions**

The research questions will determine the direction of the study by focusing on essential issues. The research questions used in this study are;

1. Regarding sustainability, what are the underlying benefits of using a shipping container home for student accommodation?
2. What is the level of acceptability among students regarding shipping container housing for accommodation?
3. What is stakeholders and developers' level of interest in venturing into shipping container housing for the purpose of student accommodation?
4. What are the developer's opinion and suggestion on the importance, durability, and measures for adopting container housing for student accommodation?

### **1.6 Limitations of the Study**

The concept of container living homes for students is a relatively new phenomenon in Nigeria. Consequently, there is a limited amount of research or literature currently available on this particular topic, which poses a challenge for researchers seeking to expand upon prior studies. Moreover, the viability and acceptance of container homes as a housing solution in Nigeria is not yet widely recognized. Researchers can encounter challenges in locating participants who are willing to participate in the research or communities that are receptive to accommodating container living initiatives. The infrastructure in Nigeria, encompassing water, electricity, and sanitation services, is potentially unsuitable for container homes. Furthermore, regulatory barriers or building

codes may not explicitly address container housing, which hinders the implementation and acceptance of such housing solutions. Conducting research on container living homes requires financial resources to implement pilot projects, secure appropriate permits, and ensure the necessary amenities are in place.

Nigeria undergoes diverse climate conditions, encompassing extreme heat, heavy rainfall, and probable flooding in certain areas. The assessment of the suitability and resilience of container homes in various climate zones is a crucial yet challenging task due to the scarcity of data or prior research on the performance of container homes under such circumstances. Research on container living homes considers the long-term durability, maintenance requirements, and potential refurbishment costs associated with these structures. The comprehension of how container homes withstand the test of time, particularly in the specific environmental conditions of Nigeria, poses a considerable challenge.

## **1.7 Chapter summary**

The first chapter of this study discusses the issue of insufficient student housing in Nigeria and proposes container housing as a solution. The goals of the study include evaluating student acceptance, analyzing feasibility, and addressing cultural considerations. Challenges include limited research, finding willing participants, infrastructure and legal obstacles, and financial constraints. Climate and sustainability are also factors to consider. Chapter 2 will explore container housing for students, including research on stakeholder interests, student acceptance, sustainability, and developer perspectives. This literature review will provide a foundation for proposing a theoretical framework to address the student housing shortage in Nigeria using container housing.

## Chapter 2: Literature Review

### 2.1 Introduction

The theoretical framework, a review of the literature, and an explanation of the major concepts make up the three main parts of the literature review section of this study. The theoretical foundation is the philosophy of sustainable development, which combines social advancement, environmental protection, and economic expansion. It offers a framework for examining how container housing might advance Nigeria's long-term development objectives, student well-being, and environmental sustainability. The review of the literature conducts a critical analysis of previously published studies, papers, and reports on container housing and student housing. It examines the difficulties students in Nigeria have in locating appropriate accommodations as well as the effectiveness of earlier solutions. Additionally, it examines programs for container housing in other nations to evaluate their successes and difficulties, particularly regarding student acceptability, cultural sustainability, economic viability, and environmental impact.

Important terminologies that encompass stakeholder participation, cultural sustainability, economic viability, and student acceptability are discussed in the Literature Review. These ideas are essential for comprehending the elements that affect students' acceptance of container housing, the requirement to take cultural considerations into account when developing housing solutions, the economics of putting container housing into practice, and the significance of involving relevant stakeholders in the process. This section builds a solid knowledge base for the upcoming analysis by synthesizing the theoretical framework, literature review, and important ideas. It discusses potential issues, offers solutions, and offers insights into the elements influencing student acceptance of container housing. It also suggests methods for creating environmentally responsible and accommodating housing options for students. At the end of the day, this literature analysis paves the way for the study's investigation of container housing as a potential remedy for Nigeria's student housing issue.

## 2.2 Theoretical Framework

This theoretical framework centers on sustainable development theory for analyzing how social progress, environmental preservation, and economic growth interact. This theoretical approach will provide a basis for examining whether container housing is a workable remedy for Nigeria's acute student housing scarcity. This study employs the Sustainable Development Theory to examine how container housing can advance environmental sustainability, benefit students' long-term wellbeing, and advance Nigeria's overall development objectives.

Three dimensions are covered by the theory. In container housing, the environmental dimension works to reduce adverse environmental effects and encourage resource conservation. Assessing waste management techniques, the use of eco-friendly materials, and sustainable water and sanitation procedures are all part of it. The economic aspect looks at the viability and economic feasibility of employing containers for housing. It entails assessing the financial viability of container housing efforts over the long term, as well as building costs, maintenance costs, possible income sources, return on investment, and cost of capital (Taleb et al., 2019). The social dimension discusses the social facets of container-dwelling sustainability. It includes social equality in housing provision, cultural compatibility, safety, and student well-being. Additionally, it takes into account how container living could affect social cohesiveness, community dynamics, and student satisfaction.

This study encompasses intricate relationships and potential conflicts between the three facets of sustainable development. It acknowledges the need to take into account the interactions and conflicts between environmental, economic, and social variables when making decisions about container housing. For instance, trade-offs with economic viability and social acceptability need to be carefully addressed while placing an emphasis on environmental sustainability. Initiatives for sustainable container housing are supported by policy and governance. There should exist strong governance structures, stakeholder engagement, and policy tools. This form of authority promotes sustainable practices, maintains compliance with environmental standards, and protects the interests of students and other stakeholders.

The Sustainable Development Theory offers a thorough framework to evaluate container housing as a sustainable option for student accommodation in Nigeria. This

research will aid in the creation of a sustainable container housing model that is in line with Nigeria's development objectives, meets the needs of students, and ensures environmental preservation and social well-being by incorporating the three dimensions of sustainable development (environmental, economic, and social), addressing interactions and trade-offs, considering indicators and assessments, and encouraging stakeholder engagement.

### **2.2.1 Review of Previous Research**

Several resources provide light on the social, environmental, cultural, and economic challenges and opportunities presented by student housing at Nigerian universities. Several writers have researched the subject of student housing in Nigeria and provided their insights.

The study conducted by Duyilemi et al. (2018) investigated the phenomenon of cohabitation within the context of Nigerian tertiary institutions, with a particular focus on Adekunle Ajasin University, located in Akungba-Akoko. The authors observed the prevalence of cohabitation among students, who noted that this phenomenon poses various challenges, including but not limited to compromised privacy, potential health risks, and academic impediments. In a study by Lawrence et al. (2018), the impact of socio-economic factors on satisfaction levels among university students residing in hostels in Southwestern Nigeria was examined. The study revealed a significant difference in the satisfaction levels of hostel facilities among students from high socio-economic backgrounds and those from lower socio-economic backgrounds.

The study by Ogungbe et al. (2018) aimed to analyze the investment potential of private student hostels in Nigerian tertiary institutions, with a specific focus on the Federal University of Technology Akure (FUTA) campus. The research findings indicate that investment in private student hostels is a profitable venture. However, it necessitates meticulous planning and efficient management. The study conducted by Ifeoma et al. (2021) investigated the challenges experienced by undergraduate students enrolled at the Federal University Wukari in Taraba State, Nigeria. The study conducted by the authors revealed that the insufficiency of suitable and reasonably priced housing poses a significant obstacle for students.

The study by Eteng et al. (2022) aimed to examine the housing satisfaction level among tertiary institution students in Calabar, Cross River State, Nigeria. The study revealed that various factors, including the geographical proximity of the hostel, the rental expenses, and the standard of amenities, impact students' satisfaction with their housing. The study by Nduka et al. (2021) investigated the correlation between indoor environmental quality and sick building syndrome in several student hostels in South-western Nigeria. The study conducted by the authors suggests a correlation exists between inadequate indoor environmental quality and the onset of sick building syndrome among students.

Student dormitories in Awka, Nigeria, were the subject of Nicholas et al.'s (2021) research on noise pollution in urban residential contexts. Students are particularly vulnerable to the negative effects of noise pollution, which the authors found to include hearing loss and elevated stress levels. The environmental risk factors of Lassa fever transmission were studied by Aigbiremolen et al. (2017) in student dormitories in Ekpoma, a semi-urban town in South-South Nigeria. The authors discovered that the transmission of Lassa fever among students might be facilitated by sloppy hygiene and sanitation.

Adama et al. (2018) examined student housing in private Nigerian universities. They found that variables like cost, location concerning campus, and access to local services all play a role in students' housing decisions. Balogun (2018) examined shipping containers in Lagos, Nigeria, as a viable alternative housing option. The author concludes that shipping containers may be used to create economical and environmentally friendly homes.

Frazelle's (2016) research on top-tier warehouses and logistics has implications for the building and management of container dwellings. Adesola (2019) summarized problems plaguing the Nigerian university system, including financial and infrastructural concerns, pertinent to the debate over alternative container housing.

Finally, Fritz et al. (2019) looked at citizen science and the SDGs set by the United Nations. Their findings are relevant to developing and administering sustainable, container-based alternatives to traditional housing in Nigeria, with an eye on achieving the UN's Sustainable Development Goals.

The sources examined offer valuable perspectives on the multifaceted obstacles confronting student housing in Nigerian universities, encompassing social, environmental, cultural, and economic dimensions. The findings of the studies emphasize the necessity of developing sustainable housing alternatives that consider the United Nations Sustainable Development Goals and the life cycle analysis of containers. The reviewed literature underscores the necessity of enhancing the quality of the indoor environment, minimizing noise pollution, and mitigating environmental risk factors such as Lassa fever. Alternative housing solutions utilizing containers have been suggested as a viable approach to tackle the housing requirements of students in Nigeria. There exists a necessity for the allocation of resources toward the advancement of the solutions mentioned above and the establishment of regulations that facilitate their integration. Solving the difficulties encountered in student housing in Nigeria necessitates a collaborative effort among multiple stakeholders, including students, universities, the government, and the private sector. Enhancing student housing facilities is expected to positively impact the standard of education and the general welfare of students in Nigerian tertiary institutions.

### **2.2.2 Container Housing and UN SDGs**

The United Nations General Assembly had a historic meeting in 2015 at which global leaders unanimously agreed to approve the 2030 Agenda for Sustainable Development. Within the ensuing fifteen years, governments would marshal efforts to eradicate all kinds of poverty, battle inequality, and manage climate change while guaranteeing that these new universal objectives exclude no one. These goals are universally applicable to every country. The accomplishment of the Millennium Development Goals (MDGs) laid the groundwork for the Sustainable Development Goals (SDGs), which seek to eradicate all types of poverty by 2030 (Habitat for Humanity, 2020). The new objectives are ground-breaking in that they demand action from all nations, regardless of their wealth level, to advance economic growth and environmental sustainability. They acknowledge that eradicating poverty has to align with initiatives that generate economic development and meet various social needs like education, social protection, health, and possibilities for employment, all while fighting climate change and protecting the environment.



The availability of sufficient housing at a price that is affordable translates to advantages in terms of education, health, and economic prospects. Making improvements to buildings can often serve as a rung on the economic ladder for families and institutions. These alterations benefit the greater community as a whole since they help reduce inequality and improve resilience amid economic and natural calamities. Other international development plans, such as the New Urban Agenda, the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction, can be supported via the execution of actions taken to improve access to appropriate and economical housing (Caldwell & Hänninen, 2021). Such actions have various implications. Housing interventions that target the accessibility of energy, and habitability via quality improvement, particularly energy efficiency and affordability, are vital for ensuring that all people have access to affordable, dependable, sustainable, and healthy energy.

Access to appropriate housing is one of the most important factors in establishing inclusive, secure, resilient, and sustainable communities. Since housing has a transformative effect on a community's societal, economic, and environmental consequences, putting housing at the heart of community development is one way to contribute to the development of better communities. The dual strategy of expediting the upgrading of poor settlements and boosting the availability of decent and cost-effective housing for poor households is essential for achieving sustainable development (Akar et al., 2017). Both strategies should be implemented simultaneously. The first step in creating more sustainable communities and cities is ensuring people can afford their houses. Building using sustainable techniques helps cut down on emissions that contribute to the causes of climate change. Developing houses and communities that are more resilient, lower risk, encourage preparation, and increase the capacity to deal with environmental stresses (Adesola, 2019). The housing market contributes to the economy's expansion by fostering the development of building industry jobs and driving up the overall demand for services and materials.

Powerful multiplier effects characterize the construction industry. Stable and appropriate housing improves economic prospects since it makes space available for home-based businesses and gives families more time to devote to profitable activities (Ceylan, 2020). The economic power of slum and informal families cannot be understated. The unofficial sector is believed to be responsible for constructing almost 70 percent of all urban housing in developing countries, making it the most important

player in the housing supply chain (BRD, 2019). The use of new technology encourages an approach to housing that is durable, inexpensive, energy-efficient, and environmentally friendly. Housing inequality reflects larger social and economic disparities in society as a whole. Communities are more successful in overcoming inequality when they have access to housing on an equal footing.

Lifecycle costs, environmental degradation, and carbon footprints are reduced when sustainable construction and design practices are used. These practices include maximizing energy efficiency and using recycled, local, and renewable resources. When it comes to construction, recycling and reuse may help cut down on the number of raw materials that are extracted and the trash that is produced. The approaches used to deal with slums, unaffordable housing, and informal settlements can potentially contribute to the general development of urban governance and planning (Haque et al., 2021). The promotion of the involvement of disadvantaged groups in decision-making is facilitated by tenure security and the acknowledgment of informal settlements. Notably, it is possible that the improvement of slums can lead to a drop in violent crime and other types of criminal activity. People can avoid choosing between their home expenditures and food prices when access to cheaper accommodation is available. Producing food on a smaller scale may be made possible by providing tenure security and sufficient housing. Adequate living circumstances make access to school and improved educational performance possible (Dave et al., 2017). Knowledge about many aspects of sustainable development, such as disaster preparation and responsible, high-quality building, may be increased via training participation and housing capacity enhancement.

### **2.2.3 United Nations Sustainable Development Goal 12**

The Sustainable Development Goals (SDGs) of the United Nations (UN) are a set of 17 global objectives intended to handle the social, economic, and natural issues the world is currently experiencing. SDG 12 also emphasizes creating and responsibly using goods. Humans must fundamentally alter how we create and use resources to achieve economic progress and continuing growth (United Nations, 2019). For example, the world's largest water consumer, irrigation, now consumes almost 70% of the water used for human consumption. Effective management of the shared natural resources and our methods for eliminating toxic waste and pollutants are key objectives to achieving this goal (United Nations, 2019). Equally important are urging businesses,

industries, and consumers to recycle and reduce their waste and helping emerging countries change their spending patterns by 2030.

Even for their basic needs, most people eat far too little. To increase the efficiency of the supply and manufacturing networks, it is essential to decrease food waste per individual on a worldwide scale at the consumer and merchant levels (United Nations, 2019). SDG 12 aims to do the following;

- Put into effect the 10-year structure of programs on sustainable consumption and production, with developed countries taking the lead and considering the skills and growth of developing countries.
- Manage natural resources sustainably and effectively by the year 2030.
- By 2030, cut down on food losses throughout the supply and production networks, including post-harvest losses, and decrease worldwide per capita food waste at the retail and customer levels.
- By 2020, achieve environmentally sound management of all wastes and chemicals throughout their life cycles per accepted international frameworks and significantly reduce their release to air, water, and soil to minimize their detrimental effects on human health and the environment.
- To greatly decrease trash production by 2030, use avoidance, reduction, recycling, and repurposing.
- Promote the adoption of sustainable practices by businesses, including big multinational firms, and the inclusion of sustainability data in their reporting cycle.
- In line with governmental objectives and policies, encourage ecologically friendly customer behaviours.
- Ascertain that by 2030 everyone will have access to the knowledge they require and is conscious of sustainable development and environmentally sound practices.
- Assist developing nations in building their technical and scientific capabilities to put more ecologically favourable production and consumption practices in place.
- Create and use tools to track how travel impacts local economies, promotes their goods, and preserves their traditions. Travel is a key component of sustainable development.

- Eliminate market distortions, considering national circumstances, including taxation restructuring and phasing out those harmful subsidies where they exist, to reflect their environmental impacts while fully accounting for the unique needs and conditions of developing countries and minimizing any potential negative impacts on their development in a way that protects people with low incomes and the affected communities.

#### **2.2.4 Types, sizes, and features of the shipping container used for housing.**

The ISO R-668 stipulates the dimension of the shipping container as follow: width of 8ft and a height of 8ft (and in some case 8.5 ft 'standard' and 9.5 ft height), having the length in two variants, the 20ft and 40ft variants as seen in Fig. 3 and Fig. 4. The vast majority of containers meet those ISO requirements. Steel makes up the fundamental frame, which supports the weight of all typical containers. It is made of weathering, corrosion-resistant construction steel (COR-TEN) or SPA-H, depending on the quality and intended lifespan. The container's walls and roof panel, on the other hand, hardly ever experience stress and serve mainly to protect the contents.

Most containers are given names according to the materials used in making them such as steel, aluminium and plywood. Eight five per-cent of all containers worldwide are built of steel because of its lower cost. Regarding the maintenance and future repairs, information on the particular building material used in producing the container is shown on the plate attached to the container (Strauch 2018). The ISO establishes minimal standards for stackability and loading capacity for safety concerns. It must be possible to stack at least six ISO containers that are at their maximum weight. Modern containers can actually be stacked up to 8 or 9. On its information plate, each container states whether it is allowed for stacking (Strauch 2018).

## 20' STANDARD

**Freight Right**  
SIMPLE, RELIABLE LOGISTICS.

Internal length	5.44m / 17.9ft
Internal width	2.29m / 7.5ft
Internal height	2.27m / 7.5ft
Tare weight	3,080kg / 6,791.4 lbs
Payload capacity	27,700 kg / 61,078.5 lbs
Cubic capacity	59.3 m <sup>3</sup> / 2,093.3 cu ft



Figure 3: A 20-foot container<sup>3</sup>

## 40' STANDARD

**Freight Right**  
SIMPLE, RELIABLE LOGISTICS.

Internal length	11.56m / 37.9ft
Internal width	2.28m / 7.5ft
Internal height	2.25m / 7.4ft
Tare weight	4,800kg / 10,584 lbs
Payload capacity	29,520kg / 65,080 lbs
Cubic capacity	67.3 m <sup>3</sup> / 2,380 cu ft



Figure 4: a 40-foot container<sup>4</sup>

<sup>3</sup> Freight Right, 2023

<sup>4</sup> Freight Right, 2023

## **2.3 The challenge of hostel accommodation in Nigerian institutions of higher learning**

The number of students attending higher education institutions in Nigeria is increasing quickly. To accommodate the growing student population, these institutions must overcome various obstacles. With an emphasis on container housing as a viable solution, this research project explores the problems and solutions related to hostel accommodations in Nigerian institutions of higher learning.

Sustainable Development Goal 12 which seeks to guarantee sustainable consumption and production patterns, is consistent with the usage of container housing for student accommodation in Nigerian higher education institutions (Fritz et al., 2019). Container dwellings provide a green answer to the problem of finding sufficient and reasonably priced housing for students at educational institutions. In addition to fostering sustainable manufacturing by using easily accessible materials and the decreased expense of constructing new dormitories, container housing encourages responsible consumption by reducing trash and energy usage.

Institutions can overcome social, cultural, environmental, and economic barriers to student housing by constructing hostels from shipping containers. Nigerian educational institutions should consider employing container housing as an alternative to conventional hostel lodging to create a secure, pleasant, and sustainable living environment for its students.

### **2.3.1 Social problems**

One of the biggest social issues educational schools in Nigeria are dealing with is the housing of students. Many students are compelled to live in congested, subpar circumstances due to the constantly expanding student population and the lack of housing options (Eteng et al., 2022). This phenomenon causes several societal issues, such as subpar living circumstances, a lack of personal space, and a higher chance of disease transmission (Ifeoma, 2021). Violence, theft, and sexual harassment increase as a result of the overcrowding in many student residences. This challenge jeopardizes the students' physical and mental health and further increases insecurity.

Also, a culture of student homelessness is emerging in Nigeria due to a lack of sufficient housing options. Due to a shortage of accessible housing choices, many students are compelled to sleep outside, including in parks and public places. Thus, children are at risk for a variety of dangers, such as crime and harsh weather (Ifeoma, 2021). Many higher schools' subpar housing options restrict access to education thus risking Nigeria's potential for long-term economic growth and development.

### **2.3.2 Cultural problems**

The integration of regional cultural features into the design of the housing units is the root of the cultural issue surrounding container housing. Nigeria is a multicultural nation with more than 250 different ethnic groups and a wide variety of languages spoken (Duyilemi et al., 2018). Each of these ethnic groups has distinctive architectural, artistic, and design aspects. The possibility for cultural insensitivity in the design of the housing units is a challenge with container housing for institutes of higher learning in Nigeria. The local community might not embrace and appreciate such housing design (Haque, 2021). Thus, they lack social cohesiveness and cultural tensions, which risks the longevity of the housing project.

The local population must be integrated through encompassing their cultural components into the design housing units. For instance, the plan can integrate traditional architectural features like the use of regional building materials, conventional construction methods, and ornamental themes (Hong, 2017). This strategy will maintain and promote Nigeria's rich cultural legacy. In addition, it will help the local people develop a feeling of cultural identity and pride. Including regional artists and craftspeople in the building process creates job opportunities and advance regional economic development (Dave, 2017). In order to increase local support and acceptance of the container housing project, it is crucial to instill a feeling of ownership and involvement in the project within the neighborhood.

A sensitive and culturally acceptable design strategy is necessary to address the cultural issue surrounding container housing for higher education institutions in Nigeria. Local cultural aspects included into the housing units' architecture foster cultural sustainability, protect Nigeria's rich cultural legacy. Moreover, it nurtures social cohesion

and economic growth in the neighborhood. The following is an example of a design that mimics traditional Nigerian architecture.



**Figure 5:A container home in the Nigerian Architectural style<sup>5</sup>**

### **2.3.3 Environmental problems**

The need to cut carbon emissions and use sustainable construction techniques is growing as the global climate crisis worsens. The ability to design environmentally friendly and energy-efficient living areas utilizing containers gives a chance to use sustainable building techniques (Nduka et al., 2021).

Reducing the energy consumption of housing units is an important environmental issue. Using energy-efficient construction components, such as insulation, high-performance windows, and roofing, can help accomplish this. The units are made to benefit from ventilation and natural illumination, which will lessen the demand for artificial lighting and cooling. Effective waste and water resource management is another environmental concern (Nduka et al., 2021). The development of container housing must consider the necessity for efficient waste management. Waste management solutions,

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<sup>5</sup> Arch Daily, 2017



such as composting toilets and greywater treatment systems, must be included into the container housing.

The installation of container housing must consider water resource conservation. Water-saving fixtures, rainwater harvesting systems, and water recycling systems provide solutions. Container housing offers a chance to use green construction techniques and save carbon emissions. According to Nicholas et al. (2021) The implementation of container housing must lower energy consumption, manage waste and water resources, and encourage sustainable living habits. Container housing is a workable and long-term solution to Nigeria's student housing shortage by solving these environmental issues. As seen in Figure 6 shows a family house under construction, while in Figure 7, we observe the finished building constructed in 8 weeks. It is worth noting the various features incorporated into the building, including wide windows that allow abundant natural light, thereby reducing the need for artificial light that adds to the energy requirements. Additionally, wooden cladding on the facade provides insulation against heat, while planting trees will ultimately mitigate urban heat and reduce the building's carbon footprint (Livinspaces, 2018).



**Figure 6: Shipping Container family house under construction<sup>6</sup>**

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<sup>6</sup> Livinspaces



**Figure 7: Finished building constructed with shipping container.<sup>7</sup>**

### **2.3.4 Economic problems**

Container housing presents a complex economic challenge. One problem with creating sustainable and reasonably priced student housing is the high price of conventional building materials like bricks, cement, and steel. The second problem is that there are few ways for schools to pay for student housing construction projects in Nigeria.

Constructing homes out of shipping containers is an answer to these financial difficulties. Shipping containers are cheap substitute for more conventional building supplies (Lawrence, 2018). The utilization of inexpensive and widely accessible shipping containers for student housing greatly cut construction and ongoing maintenance costs. In addition, the adaptability and scalability of container housing over more conventional building techniques is enhanced by the modular design of the housing components.

According to Haque (2021), the Nigerian Ports Authority (NPA) reports that Nigeria has approximately 500,000 abandoned shipping containers. Shipping companies usually abandon containers due to damage, obsolescence, or exceeding their lifespan as seen in Figure 6. The price of abandoned shipping containers in Nigeria is contingent upon their state and geographical placement. Discarded shipping containers are usually

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<sup>7</sup> Livinspaces

affordable. A 20-foot shipping container in good condition can be acquired for \$500 or less (Fritz et al., 2019).

Acquiring discarded shipping containers in Nigeria is feasible, however, certain considerations should be considered. Prior to removing a discarded shipping container from a port or other designated area, it is necessary to acquire a permit from the NPA (Dave, 2017). The businesses are accountable for delivering the container to its ultimate location. Disposal fees apply if the container is not reused or recycled.

The discarded shipping containers are of interest to not only the steel recycling industry. Additional users of discarded shipping containers are homeowners, artists, and commercial enterprises. The utilization of repurposed shipping containers is a burgeoning phenomenon both in Nigeria and globally (Caldwell, 2021). Containers are a valuable resource for creating innovative products and structures. The steel recycling industry does not compete with discarded shipping containers (Anagor, 2019). The two industries collaborate to achieve a sustainable future. The steel recycling sector recycles metal from used shipping containers, while other industries repurpose the containers (Balogun, 2018). Collaboration among industries leads to waste reduction and resource conservation.



**Figure 8:A container Dumpsite in Lagos, Nigeria<sup>8</sup>**

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<sup>8</sup> Anagor, 2019

Due to the significant risk involved with student accommodation projects, universities have trouble securing money from conventional sources like banks and financial organizations (Akar et al., 2017). Nevertheless, this issue can be resolved via the use of public-private partnerships.

## **2.4 The Solutions to Problems of Hostel Accommodation in Nigerian Institutions of Higher Learning**

A sensitive and sustainable design strategy that considers the acceptance of the housing units by stakeholders is the answer to the issues surrounding container housing for institutes of higher learning in Nigeria. According to Philip et al. (2018), including the neighborhood in the design process and using regional cultural features may increase acceptance and foster a feeling of pride and interest in the project. Solar panels and rainwater collection systems are two examples of energy-efficient design elements that may encourage sustainability and lessen the influence of the dwelling units on the environment.

The economic sustainability and scalability of the container housing method may be increased with the support of a stakeholder engagement strategy that includes investors, developers, and governmental organizations (Philip et al., 2018; Azeez et al., 2018). The container housing approach's cost-benefit analysis may assist to find prospective income streams and money-saving techniques to make the project financially viable in the long run. A thorough design and stakeholder engagement strategy that supports cultural sustainability, environmental sustainability, and economic sustainability are necessary for a sustainable and socially acceptable container housing concept for institutions of higher learning in Nigeria.

### **2.4.1 Social Solutions**

Maintaining stakeholder support throughout the project's lifespan depends on requirements and interests. Notably, it is important to include all relevant parties in the process of designing and construction (Azeez et al., 2018). Housing units, for instance, are more pleasant and conducive if students are included in the planning process (Adewale & Zubaedy, 2019). Also, including institutional administrators into the design process often results in better functional and economical hostels.

All parties must be informed and involved in the development and execution of the project. This method resolves any challenges that stakeholders have, making the container housing project more widely accepted (Azeez et al., 2018). Some ways in which stakeholders may have their voices heard and ideas considered for the project's success include holding frequent town hall meetings and consulting with local community leaders.

A collaborative strategy that includes all stakeholders in the development and implementation of alternative container housing for institutions of higher learning in Nigeria is necessary to promote its acceptance. Acceptance of the idea is boosted by better communication and using sustainable design principles (Adewale & Zubaedy, 2019). The sustainability of the container housing project hinge on social acceptance.

#### **2.4.2 Cultural Solutions**

According to Philip et al. (2018), including the neighborhood in the design process and using regional cultural features increases acceptance. Further, it fosters a feeling of pride and interest in the project. Solar panels and rainwater collection systems are incorporated in the design to encourage sustainability and lessen the influence of the housing units on the environment.

The economic sustainability and scalability of the container housing method are increased through stakeholder engagement (Philip et al., 2018; Azeez et al., 2018). Using cost-benefit analysis provide prospective income streams and money-saving techniques making the project viable. A thorough design and stakeholder engagement strategy that supports cultural sustainability, environmental sustainability, and economic sustainability are necessary for a sustainable and socially acceptable container housing concept for institutions of higher learning in Nigeria.

#### **2.4.3 Environmental Solutions**

Energy conservation and green construction techniques contribute to the environmental issue. Energy is important for heating, cooling, and lighting. If this energy usage is not properly controlled, the environment suffers (Usman, 2020). Incorporating energy-efficient design elements into the container dwelling units helps conserve the environment. The designs include energy-saving appliances such as insulation, heating and

cooling systems, and lights (Yusuf Halim et al., 2018). To offer a sustainable supply of energy, the design also includes renewable energy sources like solar or wind power.

Promoting green building methods during the construction of houses made of shipping containers is another option. Reducing the negative environmental effects of construction encompass using environmentally friendly building materials and putting waste reduction techniques into practice (Yusuf Halim et al., 2018; Babatunde & Perera, 2017; Azeez et al., 2016). A sustainable and energy-efficient design and building process is necessary to address the environmental issue with container housing.

Therefore, it is imperative to create container housing units that are ecologically responsible and agreeable to all parties by including energy-efficient design elements, sustainable construction techniques, and engaging stakeholders in the decision-making process (Halim et al., 2018). A thorough maintenance program guarantees the container housing a long-term viability.

#### **2.4.4 Economic Solutions**

The expense of constructing and maintaining the housing units is a challenge to the project's viability. The project must be economically feasible and appealing to investors and other stakeholders. There are a number of potential remedies to these economic issues.

First, it is crucial to think about the long-term financial advantages of container housing, including lower maintenance costs, increased energy efficiency, and scalability. These advantages reduce the project's initial investment costs and increase its long-term economic viability (Jacob et al., 2020; Babatunde & Perera, 2017). Second, integrating real estate developers and investors from the private sector might help with more capital and experience. Finding and working with investors that value sustainable and socially conscious investments and are aware of the potential long-term advantages of container housing is crucial (Jacob et al., 2020). Last, looking into public-private partnerships (PPP) can potentially help the project with finance and resources. PPPs include public and private sector cooperation in the financing, development, and operation of infrastructure projects (Adewale & Zubaedy, 2019). It is possible to split the financial risk and maximize the project's economic rewards by including partners from the public and private sectors.

A mix of long-term economic advantages, private sector investment, public-private partnerships, and an emphasis on sustainability can solve the economic issue facing container housing (Jacob et al., 2020). The project's economic feasibility, social acceptance, and ecologically sustainable impacts how well it addresses the student housing issue.

## **2.5 Case Studies of Successful Shipping Containers Projects.**

In recent years, container housing has gained recognition as a viable and affordable alternative to conventional building construction. Higher education institutions in Nigeria are familiar with this pattern. This study project aims to explore worldwide successful container ideas that Nigeria can embrace. The project's viability, acceptability, and alignment with the Sustainable Development Goals (SDGs) of the United Nations will all be taken into consideration during evaluation.

### **2.5.1 Keetwonen Student Housing in Amsterdam**

The Keetwonen student housing is a noteworthy illustration of a container-based initiative characterized by its sustainability and widespread acceptance. The student housing facility, situated in Amsterdam, is comprised of 1,000 shipping containers that have been repurposed for this purpose. The containers had appropriate amenities and insulation to establish a pleasant residential environment. The project was conceived with a focus on sustainability, whereby the containers were repurposed to curtail waste and limit the consumption of primary resources (Tempo Housing, 2021). The Keetwonen project illustrates a container-based initiative supporting SDG 11, which establishes sustainable cities and communities by providing reasonably priced housing within a highly populated metropolitan region.



**Figure 9: Keetwonen Student Housing in Amsterdam<sup>9</sup>**

### **2.5.2 Clemson University's Sustainable Landscape Garden**

The Sustainable Landscape Garden at Clemson University is a container project that exemplifies sustainability and inclusivity. The educational initiative is situated in South Carolina and comprises refurbished shipping containers that have been repurposed into learning areas and venues for gatherings (Clemson University, 2018). To mitigate its carbon emissions, the project incorporated sustainable elements, including solar panels and a rainwater harvesting system. The Sustainable Landscape Garden is deemed to contribute to the fourth Sustainable Development Goal (SDG 4), quality education (United Nations, 2019). This is achieved by providing a learning environment that is both innovative and sustainable for students.

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<sup>9</sup> iTINY HOUSE, 2018





**Figure 10: Clemson University's Sustainable Landscape Garden<sup>10</sup>**

### **2.5.3 Lendager Group's Resource Rows**

The Resource Rows project by Lendager Group in Denmark illustrates sustainable construction techniques through its use of container architecture. The endeavor comprises 60 cargo containers repurposed into cost-effective residential dwellings. The receptacles have environmentally-friendly attributes such as vegetated roofs, photovoltaic cells, and recycled insulation (Wilson, 2019). The Resource Rows play a role in advancing SDG 12, which pertains to responsible consumption and production, through their advocacy for using recycled materials and waste reduction within the construction sector.

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<sup>10</sup> Earth Design, 2023



**Figure 11: Lendager Group's Resource Rows<sup>11</sup>**

#### **2.5.4 The Grow Community in Washington State**

The Grow Community, located in Washington State, is a project that prioritizes sustainability and community building through container architecture. The endeavor comprises 24 cargo containers that have been converted into energy-efficient residences. The containers are equipped with environmentally friendly attributes, including solar panels, triple-glazed windows, and rainwater harvesting systems, to mitigate the community's ecological impact (Urban Land Institute, 2017). The Grow Community's communal garden fosters social interaction and environmentally conscious food cultivation. The project is aligned with the United Nations' Sustainable Development Goal 13, which aims to take urgent action to combat climate change and its impacts (United Nations, 2019). This is achieved through the reduction of greenhouse gas emissions and the promotion of sustainable living practices.

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<sup>11</sup> Resource Rows, 2017



**Figure 12: The Grow Community in Washington State<sup>12</sup>**

### **2.5.5 The Hive-Inn Hotel in Hong Kong**

The Hive-Inn Hotel, located in Hong Kong, is a project that features containers and demonstrates ingenuity and flexibility. The project comprises modular shipping containers that can be reconfigured into various room types and sizes. The hotel experience is made unique and customizable through the stacking and connection of containers (World Architecture Community, 2014). The Hive-Inn Hotel is an establishment that supports the achievement of Sustainable Development Goal 8, which is focused on promoting decent work and economic growth (United Nations, 2019). This is accomplished by providing employment opportunities for individuals in the local construction and hospitality sectors. Furthermore, the project showcases the versatility of container housing in accommodating various purposes and requirements.

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<sup>12</sup> National Association of Home Builders, 2016



**Figure 13: The Hive-Inn Hotel in Hong Kong<sup>13</sup>**

In summary, the utilization of container housing can offer viable and economical resolutions for Nigerian institutions of higher education, with a focus on sustainability. The current research project features case studies that exemplify efficacious container projects from various regions across the globe, which could be implemented in Nigeria. The projects above illustrate sustainability, inclusivity, and their correlation with the Sustainable Development Goals of the United Nations (Bertolini & Guardigli, 2020; United Nations, 2019). Nigerian higher education institutions' adoption of container housing has the potential to foster sustainable development while also affording students access to affordable housing and novel learning spaces.

## **2.6 SWOT Analysis of Container Housing**

A SWOT analysis of container housing gives a better understanding of whether or not they are a viable housing option. Through conducting this study, we should be able to

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<sup>13</sup> United Kingdom Architectural News, 2014

get useful insight into the viability of specifically constructing container homes on the Finnish market (United Nations, 2019). The SWOT analysis is a four-field model that was developed to map an organization's internal threats and opportunities in addition to its weaknesses and strengths. The acronym SWOT is frequently employed to evaluate a company's strengths, weaknesses, opportunities, and threats; however, it may also be used to discover and assess learning opportunities and prospective issues.

### **2.6.1 Strength**

Since it typically has a floor, walls, and a rooftop, a container makes for an excellent platform upon which to begin construction. It is not difficult to cut out openings or other required pieces such as holes for ventilation systems. This requires very little effort on your side. Containers are not only hard but also resistant to the elements, which means they can withstand more severe circumstances with relative ease (The Global Challenge for Government Transparency, 2020). When constructing a house out of shipping containers, another significant advantage is the ability to stack one container atop another, which introduces a wide range of new design options. Buying a secondhand container is an affordable option since there is a plentiful supply of them. In most cases, the difficulty with containers is that after they have been carried to their locations, they often become useless since there is usually nothing left to be brought back to the site where they were originally stored (Taleb et al., 2019). The fact that containers are reused after serving their primary function is another reason why their use is considered to be particularly environmentally beneficial. As a result of the fact that their dimensions have previously been defined to be compatible with various modes of transportation, containers may be moved about with relative ease (Islam et al., 2016). The storage solution is very safe, and breaking into them would take a blow torch or other major equipment. Since they are very heavy to transport on a truck if they are connected to utilities and lifted off the surface, this makes it much safer for the customer to own a container-built home in the countryside while it is not in use.

### **2.6.2 Weakness**

The installation of a ventilation system, which are essentially air conditioning mechanisms with built-in mechanical systems, is a pricey proposition for container homes.

These systems are centered on improving the quality of the air, and as a result, they heat up or cool down the inside of the container depending on whether it is located in a much warmer or colder country (Akar et al., 2017). In addition to that, these prefabricated dwellings made from shipping containers need to have enough insulation that is capable of warding off the cold throughout the winter months, particularly with regard to the Finnish market. With all of the excitement around this new discovery of alternate housing options, it is difficult to implement and expensive to transport across great distances (Caldwell & Hänninen, 2021). It is easier to purchase containers when living in bigger cities close to the port. Moreover, it can also be challenging to locate containers that are appropriate for transforming into dwellings of some kind. This is mostly since it is difficult to determine what the boxes were used for in the past while they were being transported (Ceylan, 2020). Especially if they were utilized to transport chemicals or containers containing unknown resources, in which case they will undoubtedly need the appropriate painting jobs as well as nontoxic primers. Due to the fact that containers are not frequently utilized as a kind of construction material yet, it will be difficult to locate a contractor that has expertise in this field (Climate Smart, 2020). And last, persons who are not used to this appearance may have a negative reaction due to the appearance's contentious nature.

### **2.6.3 Opportunities**

Housing that is portable and quick to erect already has a market. Home units are scarce in developing nations. Some people may find the concept of residing in a cargo container strange, unrealistic, and even somewhat unattractive. However, it is crucial to see cargo containers as resources - as the exoskeletons of futuristic dwellings - rather than completed goods (Ceylan, 2020). There is a growing market for new development in other nations that have tried this concept, indicating population increase and quick urbanization. They also provide lovely temporary homes. With this idea, there are several opportunities given the present state of the property market (Habitat for Humanity, 2020). When moving a container, it is preferable to hire or have a tilting roll-off truck so that the container may simply slide off. The sustainable clean term "Adaptive Reuse," which has been coined in several nations as a result of trade imbalances in many areas globally, is the considerable benefit and potential of utilizing a container (Haque et al., 2021). According to this idea, removing these vessels from

shipyards where they take up unnecessary space and replacing them with environmentally friendly housing offers a number of benefits and addresses the housing crisis as well as the issue of unused storage containers at Nigerian ports.

#### **2.6.4 Threats**

It is possible that older containers are not as level as newer ones, thus extra effort may be required to transform them into useful materials that may be used in the construction of a structure. In alternative housing, there are misunderstandings over construction rules and permissions. This is particularly true when it comes to obtaining a home bank loan. In hindsight, there will be a great deal of room for interpretation of the events that took place during the process (Taleb et al., 2019). The use of a container might have resulted in the shipment of hazardous materials or toxins, which would put the local population in danger, this possibility exists. In order to prevent such problems, the container has to be subjected to extensive testing in order to determine whether or not it is acceptable for use as a component of a structure (Hong, 2017). By thoroughly cleaning the container in advance, there is the potential to circumvent the effects of this sort of damage and take preventative measures. Rust is the sole natural danger that may be posed by a container; hence, it is preferable to use the appropriate equipment and safer chemicals in order to ensure the safety of the painting process (Haque et al., 2021). In terms of heat, however, these steel containers may either function as ovens or freezers, based on the weather outside; thus, it is essential that they have superior insulation, aeration, and air circulation, particularly in Nigeria.

#### **2.6.5 Advantages and Disadvantages of Using Shipping Containers**

The rising need for housing throughout the world has led to the creative use of shipping containers as a sustainable and inexpensive housing option. There are advantages and disadvantages to consider while deciding whether or not to use shipping container housing for universities in Nigeria. Shipping container homes have a number of advantages, one of which is their low price (Samson) et al., 2022. It is more cost-effective than conventional construction practices, thus it's a good fit for Nigerian universities. Also, it last for a long time to serve its long-term purpose. One way to reduce waste and save resources is to build homes out of recycled shipping containers.

Housing built from shipping containers is not only affordable, but also quickly relocated, making them a great option for universities in need of short-term housing options. In addition, shipping containers may be customized to fit a variety of uses and aesthetic preferences. Last, students feel protected knowing that shipping containers can withstand harsh climates and acts of vandalism (Islam et al., 2016). There are, however, certain drawbacks that encompass building housing structures using shipping containers. The inherently cramped nature of shipping containers is a major drawback that makes it difficult to house a large number of pupils in one location. Insulating shipping containers such that they may be used as living quarters is difficult in cold and hot climates alike (Haque et al., 2021). Permitting shipping container dwellings might also be challenging, depending on the specifics of the area in question. In addition, some communities are often reluctant to embrace shipping container housing because of the stigma that surrounds it.

## **2.7 Government Regulation of Shipping Containers in Nigeria**

Building codes and standards are crucial for safe and sustainable construction practices. Building codes in Nigeria are established and enforced by government agencies at the federal, state, and local levels. Building codes cover structural integrity, fire safety, electrical and plumbing systems, and accessibility. Regulations for container homes may be limited or nonexistent (Haque, 2021). The regulatory measures pertaining to planning and zoning serve as the fundamental structure for the utilization and advancement of land within a particular administrative area. The regulations exert an influence over the permissible location, density, and typology of structures in diverse zones (Islam et al., 2016). A comprehensive comprehension of the planning and zoning regulations in Nigeria is imperative for evaluating the viability and reception of container homes in particular localities.

One of the legal challenges faced by shipping container housing pertains to adherence to construction norms and regulations. While shipping container housing can offer cost and environmental benefits, it could miss to meet the basic standards required for traditional residential structures (Ahn et al., 2019). To ensure adherence to safety and health regulations, it is imperative to implement specific regulations and building standards for alternative container dwellings.



Acquiring the necessary authorizations and approvals for constructing and inhabiting shipping container dwellings constitutes an additional regulatory obstacle. Obtaining consent from various entities, including regional planning commissions, construction inspectors, and zoning boards, is necessary (Haehl & Spinler, 2018). Organizations often exhibit hesitancy in granting approval for shipping container housing owing to challenges associated with aesthetics, security, and safety.

Notwithstanding the challenges associated with regulations, there exist benefits to utilizing shipping containers as a housing solution. Shipping container housing has the potential to contribute towards the achievement of the UN SDGs, particularly in the domains of affordable housing, sustainable cities and communities, and responsible consumption and production (Ceylan, 2020). Furthermore, the utilization of shipping containers as a housing option could potentially offer a unique resolution to the issue of affordable accommodation within Nigeria's tertiary education institutions. Academic institutions have the potential to offer affordable and comfortable lodging options for their faculty and staff, while also reducing their ecological footprint through the utilization of refurbished shipping containers (Eteng et al., 2022). The utilization of shipping containers as a housing solution is a viable option for promptly addressing pressing housing needs due to its expeditious and efficient construction capabilities.

Shipping container homes can face challenges in gaining acceptance from certain communities. Effective education and awareness campaigns can facilitate the dissemination of information regarding the benefits of shipping container housing, which can potentially address the affordable housing crisis and promote sustainable development within communities (Ceylan, 2020). In order to increase the acceptance of shipping container housing within communities, it may be beneficial to disseminate comprehensive information regarding this innovative housing option and dispel any misconceptions pertaining to its safety and security concerns.

To sum up, the utilization of shipping container housing in Nigerian higher education institutions presents both legal considerations and potential opportunities. If executed appropriately, this approach has the potential to support sustainable development and align with the United Nations' Sustainable Development Goals. Additionally, it presents a feasible, rational, and innovative resolution to the issue of affordable housing.

## **2.8 Public Perception of Shipping Container Housing**

The use of shipping containers as an alternative housing solution has gained global attention in recent years. According to Boudet (2019), sustainability, cost-effectiveness, and usefulness are only a few of the variables that shape the public's opinion of housing made from shipping containers. Shipping container homes are one alternative housing solution that is highlighted as a way to advance sustainable development. Projects like this have already demonstrated their worth to public and commercial organizations because to their low costs and long lifespans.

The public's impression of homes made out of shipping containers presents certain difficulties. Some individuals consider container dwelling as unattractive and lack of aesthetic appeal. To solve this, designers and architects have combined inventive designs and imaginative use of space to create aesthetically beautiful container houses (Balci, 2021). Additionally, container housing projects have been proven to have a favorable influence on the local community and economy, boosting social and economic growth. As a result of its environmental friendliness and low-price tag, housing made from shipping containers is gaining popularity around the world (Ceylan, 2020). Because of its potential to help the surrounding neighborhood and its connection to the United Nations' Sustainable Development Goals, it is a good solution for universities and colleges in Nigeria. In order to increase the public's acceptance of container housing, designers and architects must keep making it more aesthetically pleasing.

### **2.8.1 The Perception of Shipping Container Housing Nigeria as A Solution to Student Housing Deficit in Nigeria**

Overcrowding and poor living circumstances are common among Nigeria's student population because of the country's inadequate housing supply. Shipping container dwellings are one alternate approach presented to deal with this problem. Affordable and eco-friendly homes made from shipping containers are becoming more popular worldwide.

Because of its durability and low cost, housing made from shipping containers has become more popular worldwide. According to Caldwell and Hänninen (2021), the United States, Australia, and the Netherlands are a few nations that have successfully adopted the usage of shipping containers as a kind of housing. Modular, inexpensive,

and easy to build, homes made from shipping containers are more popular (Bologun, 2018). Housing made from recycled shipping containers is an eco-friendly option since it helps cut down on waste and promotes the circular economy.

Sustainability must be a top priority when solving Nigeria's student housing crisis; repurposing containers for living space is an environmentally friendly choice. Constructing recycled shipping containers helps the environment and promotes a more circular economy (Anwar, 2020). Solar panels, rainwater harvesting, and energy-efficient systems are just a few examples of the eco-friendly additions that may be made to a home built out of shipping containers. Shipping container homes are a viable answer to Nigeria's student housing crisis, but only if they are widely accepted. Shipping container housing encounter difficulties in gaining public approval because of the negative stereotypes developed around it (Akar et al., 2017). However, the widespread adoption of housing made possible by shipping containers in other nations shows that this is a workable alternative.

Finally, the need for more affordable accommodation for students in Nigeria will be remedied by constructing dwellings out of shipping containers. The fact that it fits in with the United Nations' Sustainable Development Goals (SDGs) and has been used well in other nations is evidence of its potential. However, the widespread adoption of container dwellings in Nigeria is still a significant obstacle to overcome. Safe, inexpensive, and environmentally sound shipping container housing are an excellent option for Nigerian universities if designed with local tastes.

### **2.8.2 The Acceptance and Resistance to Shipping Container Housing in Nigeria**

The United States, Australia, and the United Kingdom have successfully used shipping container housing. Container homes, for example, have been utilized to offer low-cost housing options for homeless people and their families in the United States (Zafra et al., 2021). In Australian cities, container homes have been used as temporary shelters and low-cost housing. Container homes are becoming more popular in the UK to provide emergency shelter for migrants.

The environmental friendliness of container dwellings is a further factor. Reusing shipping containers for living quarters helps reduce waste and saves on building materials. Additionally, shipping containers are robust and can endure harsh climates, making

them an excellent option for housing in disaster-prone regions (Tempo Housing, 2021). Insulation, solar panels, and rainwater collection systems are examples of energy-saving additions to container-based dwelling designs.

Container homes have met a lukewarm reception in Nigeria. The proposal has been welcomed by certain universities but rejected by others. One primary ground for opposition is the widespread belief that container homes cannot be built in Nigeria due to the country's hot and humid environment (Ahn et al., 2019). However, with thoughtful planning and insulation, dwellings manufactured from shipping containers are habitable in Nigeria. The visual appeal of container homes is seen as another cause for opposition. Container homes may seem attractive via clever design and landscaping.

The level of support or opposition to utilizing shipping containers as homes in Nigeria is a crucial factor to consider when deciding how to house students in alternative settings like universities. There is a divide in opinion regarding how well it will do in the Nigerian environment and how attractive it would be (Dave et al., 2017). Housing built from shipping containers may be insulated and designed to withstand the harsh Nigerian environment, and it can also be landscaped to provide curb appeal. Container housing has the potential to offer low-cost and long-term housing options in Nigeria, especially for educational institutions.

## **2.9 Chapter Summary**

Chapter 2 reviews container housing for student accommodation in Nigeria, exploring its potential to contribute to sustainable development and improve student welfare. The literature examines previous studies and container housing projects in other countries to assess their successes and limitations.

The definitions of key terms related to stakeholder involvement, cultural sustainability, economic viability, and student acceptability were thoroughly covered. Understanding the factors influencing students' acceptance of container housing, the significance of taking cultural considerations into account when coming up with housing solutions, the economic viability of implementing container housing, and the importance of involving relevant stakeholders in the process are all dependent on understanding these concepts. This chapter laid the groundwork for analyzing container housing by building a

theoretical framework, reviewing literature, and identifying potential problems and solutions. This sets the stage for further investigation.

Chapter 3 concentrates on the research approach used in this study, building on the theoretical framework and literature review. It provides an overview of the research strategy, data collection methodologies, and data analysis methods used to look into Nigerian students' approval of container housing. This chapter direct the process of conducting empirical research and aid in achieving the goals and questions of the study by presenting a structured and organized strategy.

## Chapter 3: Methodology

### 3.1 Introduction

In order to assess the housing crisis facing Nigerian college and university students, this research examined the feasibility of building student housing from shipping containers. Quantitative approaches to data collection were used in this study.

### 3.2 Research Design

A quantitative research strategy was used to conduct this investigation. Students from a sample of Nigerian universities from Abuja and Lagos were surveyed using questionnaires, while a literature review formed the backbone of the qualitative research. The study was designed to evaluate the viability of shipping container housing when used for student accommodation purpose, and it involved different steps in achieving the goal as established in figure 14.

Survey methodology were used to obtain data from a representative sample of 140 participants in this study using stratified sampling. From an approximate population of 53,200 participants, the sample was calculated as follows;

$$\text{Population size} = (n * 0.95) / (0.05)^2$$

$$53,200 = (n * 0.95) / (0.05)^2$$

$$n = 140$$

The questionnaire used to gather information for this study was split into two sections; the first entailed demographic data while the second evaluated acceptability of container housing among students and developers. The questionnaire was developed in light of the study questions and was pilot tested to guarantee its validity and reliability. Participants were chosen because they were easily reachable and showed interest in the survey.

The study's context was established by an examination of pertinent materials, such as government regulations and reports on student accommodation difficulties in Nigeria. The literature on student housing in Nigeria, the problems associated with it, and possible solutions were examined.

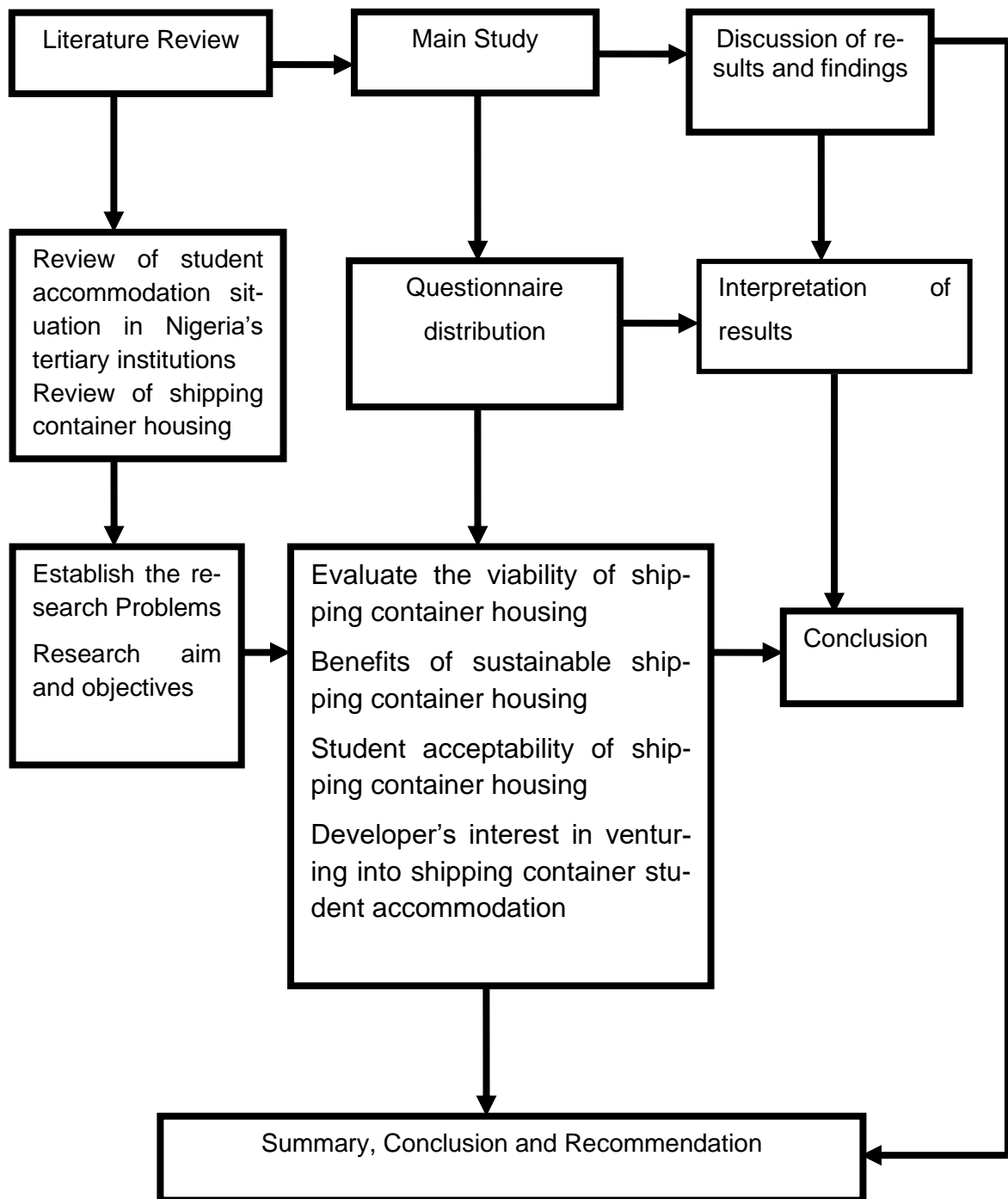


Figure 14: Research design outline<sup>14</sup>

<sup>14</sup> Author

### **3.3 Data Collection Methods**

The questionnaire survey was used as the main technique of data collection for this project. The purpose of the survey was to get feedback from university students and other relevant parties in Nigeria on the feasibility and desirability of employing shipping containers to address the current housing crisis. The research questions informed the development of the questionnaire, which was piloted with a subset of respondents to ensure its validity and reliability. To find problems with the questionnaire design and modify the phrasing of the questions, a sample of 30 participants from Nigerian universities filled a preliminary version of the questionnaire. The pilot study ensured the questionnaire was straightforward. The survey was sent out online using Google Forms and the respondents used emails to send back their filled questionnaires.

Google Scholar, JSTOR, and ScienceDirect were used to get access to the documents. The search centered on articles, blogs, and social media posts on shipping containers homes. The secondary data collection supplemented the main data collection by providing a real-world setting for the research. The study's data-gathering strategies provided a rich and substantial data set, which was mined for insights into the study's central research issues and in service of its stated goals. The validity and reliability of the results were ensured using both primary and secondary data-collecting techniques.



### 3.4 Data Analysis

Descriptive statistics like frequencies, percentages, means, and Relative Importance Index were used to examine the information gleaned from the questionnaire survey. This data was used to summarize the characteristics of the respondents and discuss their opinions on shipping container housing as a possible solution to the housing shortage in Nigerian universities. The study was tested using inferential statistics such as Relative Importance Index.

Using the research questions as guides, the replies were classified and organized into overarching themes and more specific subthemes.

#### 3.4.1 Frequency distribution table

A straightforward and clear method of displaying questionnaire results in rows and columns requires the use of frequency distribution table, and that has been adopted in this research.

#### 3.4.2 Mean score

Factors that relate to student acceptability of shipping container housing for accommodation purposes and the drivers that influence real estate developers decision to venture into using shipping container housing for the purpose of student accommodation were rated on a 5-point likert scale and the significance of each variable was assessed. This assessment gave credence to the conclusions that were drawn up in this research. Conversion of the scale was done into average scores know as the Mean Item score (MIS) and a score allocated to each of the variable to ascertain their importance. The MIS is represented in the formula shown below.

$$\text{Mean Item Score (MIS)} = \sum \frac{(f X s)}{N}, (1 \leq 5)$$

Where;

F = Frequency of responses to each rating (1-5) for each variable

S = Score given to each variable by respondent on a scale of 1 to 5

N = Total number of responses related to the factor.

“1” means “strongly disagree” and “5” means “Strongly agree”.

### 3.4.3 Relative importance index

Relative Importance Index was be used to rank the weight of relevance attached to each factor under review as decided by the students and the developers/ professionals.

$$\text{Relative Importance Index (RII)} = \frac{\sum fx}{\sum f} \cdot \frac{1}{k}$$

**Where,**

$\sum fx$  = is the weight given to each attribute by the respondents.

$\sum f$  = is the total number of respondents in the sample.

K = is the highest weight on the likert scale

Based on the RII values, the object under valuation were ranked, the items that had the highest RII value is rated first (1) followed by the item number two (2) having the next highest value and so on. The values of each factor’s respective relative importance index (RII) was used to rate each factors level of relevance. Based on their RII, the objects under evaluation were ranked.

Vanduhe (2012) interpreted the RII values as follows:

$\text{RII} < 0.44$ , factor is assessed to be “Not significant”.

$0.45 \leq \text{RII} < 0.66$ , Factor is assessed to be “Fairly significant”.

$0.67 \leq \text{RII} < 0.75$ , factor is assessed to be “Significant”.

$\text{RII} \geq 0.76$ , Factor is assessed to be “Very significant”.

### 3.5 Ethical Considerations

Many ethical considerations were made throughout the course of this study's execution to guarantee the security of the participants and the quality of the data collected. They must have enough time to ask questions and make an educated decision about whether or not to take part in the research. This is part of the informed consent process, which will entail explaining the study's goals, methods, risks, and potential benefits

(Arifin, 2018). Also, volunteers were aware that they were under no obligation to continue with the research and may quit at any moment.

The information collected was maintained in strict confidence and anonymity to safeguard the privacy of research participants. Data collected from participants was kept in a secure location and the identity of the participants were anonymous (Arifin, 2018). All acquired data were de-identified before use in presentations or publications. This study followed all data protection legislation and procedures for the safety of the information provided by study participants. The information provided were kept confidential and used for scientific analysis.

This research sought to find out whether the use of shipping containers for student housing would be a viable solution to the shortage of dorm space at Nigerian universities. To this end, this study used a mixed-methods strategy, which included both primary and secondary data-gathering strategies, as well as descriptive and inferential analyses of the gathered information. All participants were treated with the utmost respect during the study.

### **3.6 Chapter summary**

Chapter 3 discussed the research approach, including data collection and analysis methods, to evaluate the feasibility of building student housing using shipping containers in Nigeria. The research involved a questionnaire survey of Nigerian university students. A survey was conducted to gather insights on student approval of container housing and factors affecting real estate developers' decisions. A literature review highlighted the importance of investigating relevant information on student housing and government regulations. Thorough and diverse methods were used to gather data.

Descriptive statistics, such as frequencies and percentages, were used to evaluate the survey data to describe the characteristics of the respondents and their views on container housing. To rate the importance of the numerous factors found in the study, inferential statistics, such as Mean Score and the Relative Importance Index, were used. The study shifts to Chapter 4, where the emphasis were on presenting and interpreting the data, the survey results presented in this chapter, together with a thorough analysis of the data that sheds light on student opinions, the acceptability of container housing, and the perspectives of real estate developers. The study helped to

achieve the research goals and offer insightful information about how container housing can be used to relieve the lack of student housing in Nigerian universities.

## Chapter 4: Data Analysis and Discussion of Results

### 4.1 Introduction

This chapter of the study entails Data analysis for the validation purpose. It links the research findings with related exiting literature concerning shipping container housing successes and the viability of rolling out the idea for the purpose of student hostel accommodation. Chapter 4 furthermore is divided into sections that discuss general introduction, data presentation and analysis, questionnaire design and response among others.

### 4.2 Questionnaire Design and Response

In achieving the aim and objectives of this study, a questionnaire was carefully designed and administered to respondents. The questionnaires as attached on Appendix 1 in page 82 which was in two sets, designed for students in higher institutions (In Lagos and Abuja) and professionals in the construction industry were administered to the respective respondents. The expected target number was 140 (70-students and 70-Professionals). However not all the administered questionnaires received responses. From Table1 below, seventy questionnaires (70) each were administered to students in tertiary institutions in Nigeria and Developers/professionals in the construction industry. Out of these numbers, and fifty eight (58) and forty four (44) was filled and returned which represented 82.9% and 62.9% for students and professionals respectively, hence it is pertinent to say the outcome of the survey is deemed significant this is in line with the assertion made by Moser and Kalton (1971) stating that an outcome of a survey that is not below 30 to 40% is sufficient for analysis.

Administered	Students		Developers/Professionals	
	Frequency (No)	Percentage (%)	Frequency (No)	Percentage (%)
Returned	58	82.9	44	62.9
Unreturned	12	17.1	26	37.1
Total	70	100	70	100

**Table 1:** Respondent category and number of questionnaires<sup>15</sup>

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<sup>15</sup> Author

### 4.3 Personal Information

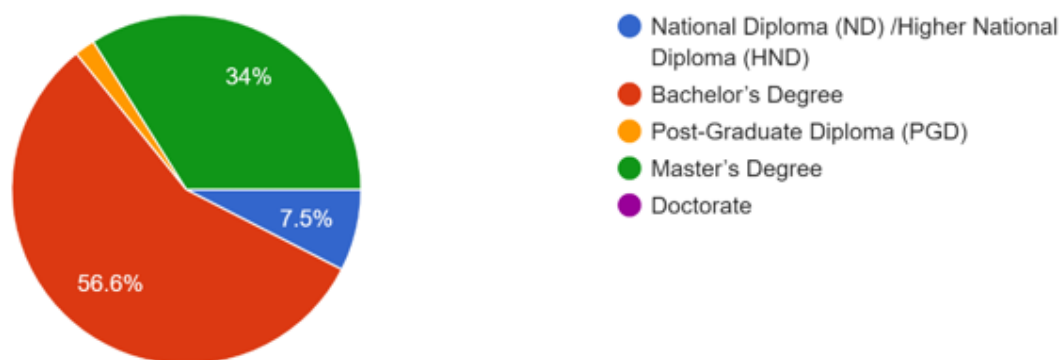
This section considers the personal information of the respondents (Students), it borders around their age, educational level and type of accommodation they lived in, while in school. Table 2 shows the age distribution of the students that were reached out to in the course of this survey, it reveals that over fifty percent (50%) of the respondents were in the age range of 26-35.

Age	Percentage (%)
16-25	33.3
26-35	50.9
36-45	17.5

**Table 2:** Age distribution of the respondents in the student category<sup>16</sup>

#### 4.3.1 Respondents Educational Level

The chart below represents the educational level of the respondents which were students. A total of 58 responses from the students shows that over fifty percent were Bachelors degree students, the next largest portion represented students with Masters degree and they made up 34% of the respondents. The least on the chart were students who are in the category of National diploma/ Higher National Diploma (ND/HND) and they represented 1.9% of the total respondents.



**Figure 15:** Respondent Education Level<sup>17</sup>

<sup>16</sup> Author

<sup>17</sup> Author

#### 4.3.2 Type of student accommodation respondents lived.

The chart below shows the different kind of accommodation students in tertiary institutions in Nigeria live in. Figure 13 shows the type of accommodation students stay in, while in tertiary institutions in Nigeria. It can be seen that single bed accommodation and shared apartment made up for almost half of the total responses, having 24.5% each, with off-campus accommodation topping the chart with 34%, this is in line with (Ogungbe et al 2018) which asserted that investors concentrate of building accommodation for student off-campus, and were of the opinion that investors should focus on developing students accommodation on-campus rather than off-campus.

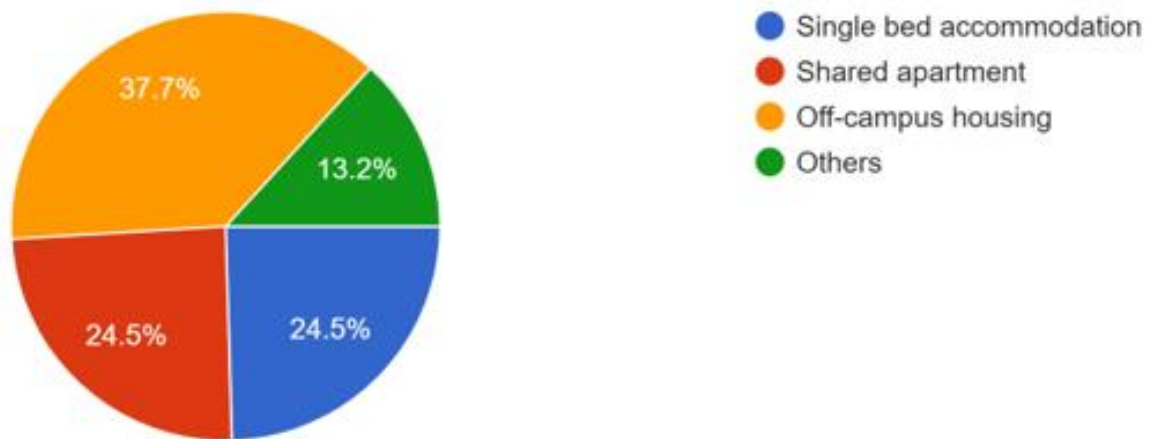
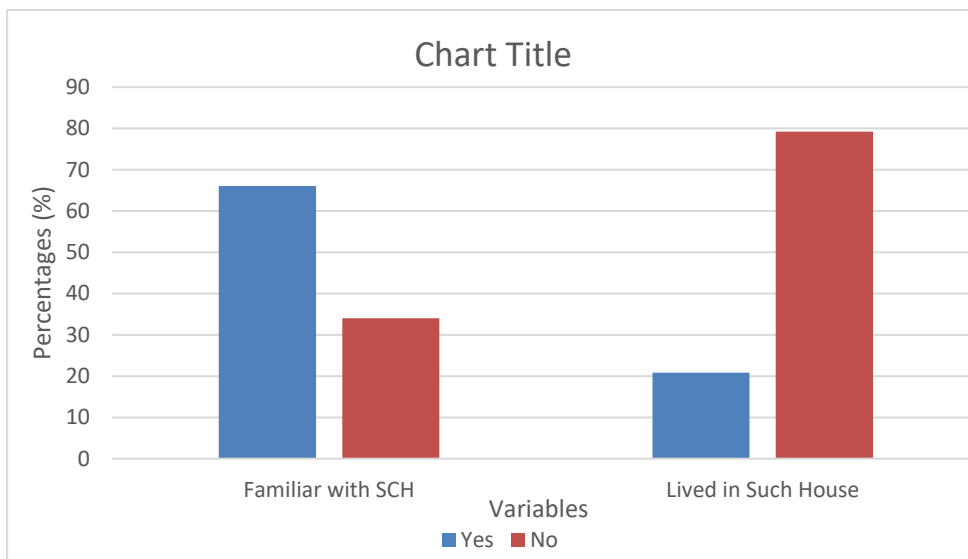


Figure 13. Types of student accommodation<sup>18</sup>

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<sup>18</sup> Author

Figure 14 shows the level of acquaintance of students with shipping container housing and those that have lived in a shipping container home. It can be seen that 66% of the respondents agree that they are familiar with the concept of shipping container housing, and 34% say they are not familiar with the concept. Furthermore, only 20.8% of these respondents have stayed in shipping container housing. This goes to show that the awareness is growing, and more awareness needs to be created to promote the usage of shipping container housing for accommodation purposes.



**Figure 14.** Level of acquaintance of students with shipping container housing<sup>19</sup>

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<sup>19</sup> Author



## 4.4 Student acceptability of the concept of shipping container housing

### 4.4.1 Factors that influence student acceptability

The table below shows how students who are the respondent in this case ranked the following factors as they relate to shipping container housing. From Table 3, regarding factors that influence shipping container housing for student accommodation, students ranked the benefit “Quick to construct” first 1st with an RII of 0.74 which indicates a significant agreement, next in the second position of the ranking is “ease of transporting” with the RII of 0.72 which is also a significant level of agreement. Least on the table of the 5 factors mentioned here is “Cost effective”, having a relative importance index of 0.63 showing that the students recognize these benefit derived from constructing shipping container housing.

s/no	Factors that influence acceptability	Frequency of response					$\sum f$	$\sum fx$	Mean	RII	Position
		1	2	3	4	5					
1	Cost effective	8	9	9	18	8	52	165	3,17	0,63	5th
2	Environmentally friendly	5	7	13	12	12	49	166	3,38	0,67	4th
3	Easily transportable	6	5	12	17	14	52	188	3,61	0,72	2nd
4	Quick to construct	4	5	8	19	15	51	189	3,70	0,74	1st
5	Durable	4	9	8	18	12	51	178	3,49	0,69	3rd

**Table 3:** Factors that affect student choice and acceptability<sup>20</sup>

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<sup>20</sup> Author

#### 4.4.2 Factors that influence students choice of accommodation

Table 4 shows the factors that influence students choice of accommodation. The respondents who are students in higher institution ranked security factor first 1st with an RII of 0.81, which represents a very significant factor. Furthermore Location and accessibility was ranked 2nd having an RII of 0.8, this also represent a very significant factor. This may be attributed to the points reeled out by Olanrewaju et al., (2022) where he pointed out that in the middle of the 1980s, acute problem in student housing in Nigerian tertiary institutions gave way to off campus dwellings, and these were associated to insecurities, epileptic water and electricity supply, coupled with ineffective municipal transport system. Third on the ranking list is environmental sustainability, this points to the fact that students in tertiary institutions in Nigeria are beginning to accept and embrace the concept of sustainability. Of all the factors presented to the respondents, rental cost was ranked 7th having the lowest RII of 0.71.

s/n	Factors	Frequency of response					$\Sigma f$	$\Sigma fx$	Mean	RII	Position
		1	2	3	4	5					
1	Rental Cost	5	10	4	17	16	52	185	3,55	0,71	7th
2	Environmental sustainability	1	1	12	22	15	51	202	3,96	0,79	3rd
3	Space and comfort	3	7	8	15	19	52	196	3,76	0,75	5th
4	Location and accessibility	2	5	5	18	22	52	209	4,01	0,80	2nd
5	Energy efficient design	2	8	12	15	15	52	189	3,63	0,73	6th
6	Security	4	3	5	13	27	52	212	4,07	0,81	1st
7	Standard of amenities /facilities	1	6	6	20	18	51	201	3,94	0,78	4th

**Table 4:** Factors that influence students choice of accommodation<sup>21</sup>

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<sup>21</sup> Author

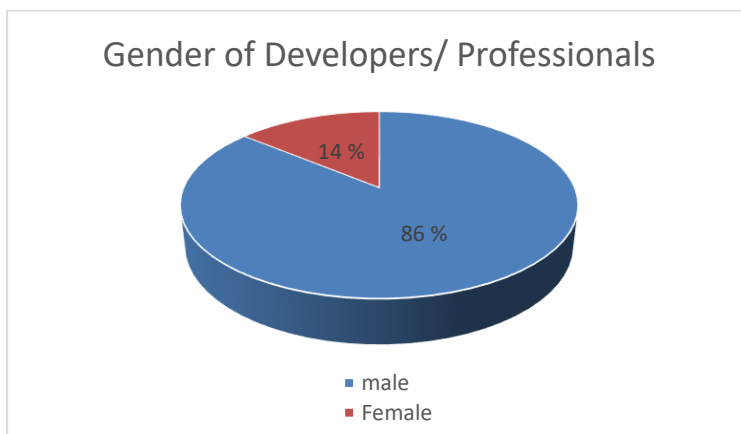
## 4.5 For Construction Professionals and Developers

### 4.5.1 Section A: General Information

#### Gender

According to Figure 14, the gender distribution among developers indicates that a majority of 86% of the participants were males, whereas a minority of 14% identified as females. The survey results reveal a noteworthy preponderance of female developers in comparison to their male counterparts within the surveyed population. Noteworthy, the gender distribution presented in this study pertains solely to the sample of respondents who took part in the survey, and thus, is not be indicative of the wider population of developers. The interpretation of the survey findings is contextualized by considering the sample size and the demographic attributes of the participants.

Comprehending the gender distribution in this survey provides insights into the representation and participation of diverse gender groups within the developer community. The identification of potential gender disparities, comprehension of diverse gender experiences and perspectives within the field, and development of strategies to foster inclusivity and diversity within the industry are all potential benefits.



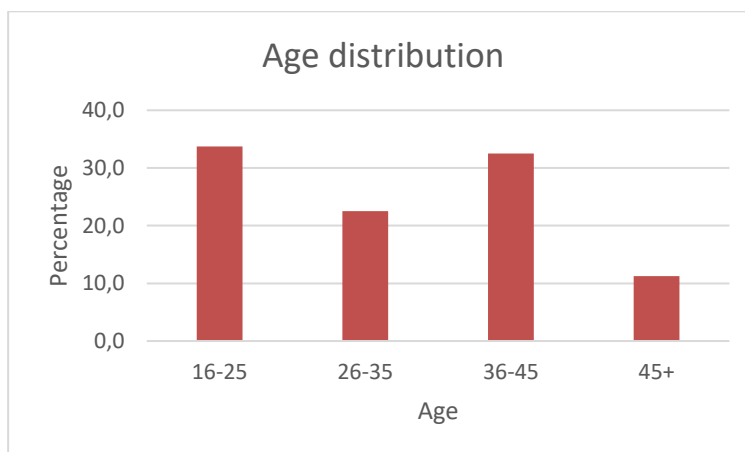
**Figure 14.** Gender of Developers<sup>22</sup>

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<sup>22</sup> Author

### 4.5.2 Age distribution of the respondents

The bar graph above offers valuable insights regarding the age distribution of the developers who took part in the survey. The age range of 16-25 years old accounted for the largest proportion of developers, comprising 33.8% of the sample. This finding suggests a notable representation of younger individuals within the developer community. The age cohort of 36-45 constituted the second most populous group, representing 32.5% of the developers surveyed. The study revealed that individuals between the ages of 26 and 35 accounted for 22.5% of the sample, whereas respondents aged 45 and above represented 11.3% of the surveyed cohort. These percentages offer an in-depth knowledge of the age demographics within the developer community, thereby exposing the predilections, encounters, and obstacles encountered by developers across various age cohorts.



**Figure 15.** Age distribution of developers<sup>23</sup>

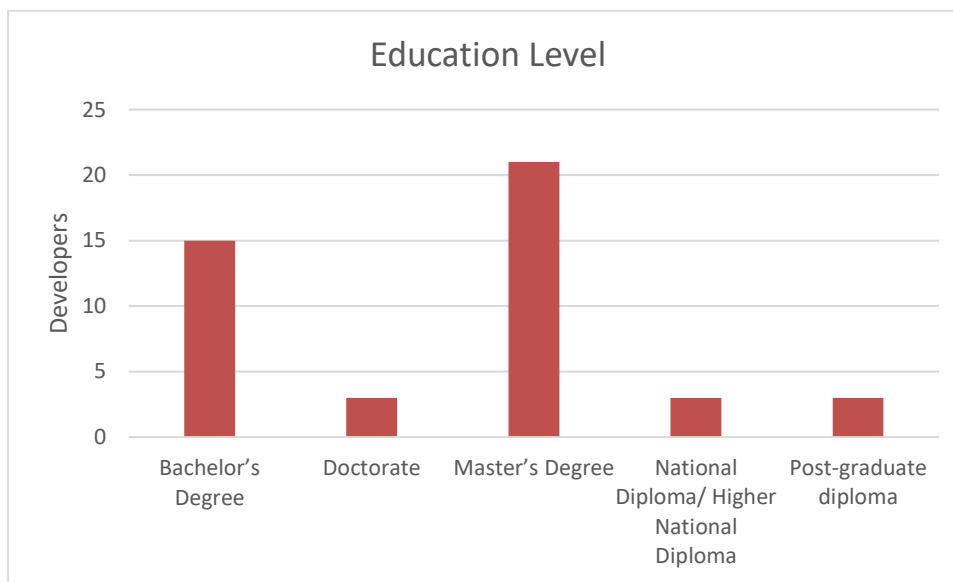
### 4.5.3 Educational level

Figure 16 revealed the distribution of developers from various academic backgrounds, with percentages representing how many developers belong to each category. According to the study, a little over a third (33.3%) of the developers had earned a Bachelor's degree or above. This suggests that many of the developers had completed a four-year bachelor's program. Only 6.7% of developers had earned a Ph.D., but

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<sup>23</sup> Author

those who had done so had shown exceptional mastery of the topic via published research and other scholarly accomplishments. The majority of developers, or 46.7% of those who took part, had a Master's. This finding highlights the prevalence of elite educational paths among developers, suggesting a value placed on highly specialized skills and knowledge. A reduced percentage of developers, specifically 6.7%, indicated possessing a National Diploma or Higher National Diploma. This suggests that some builders have chosen to enhance or replace their academic degrees with more practical training. Similarly, 6.7% of the developers polled had completed a post-graduate certificate program, suggesting the presence of a minority of developers who had pursued a unique kind of education beyond their undergraduate degree.



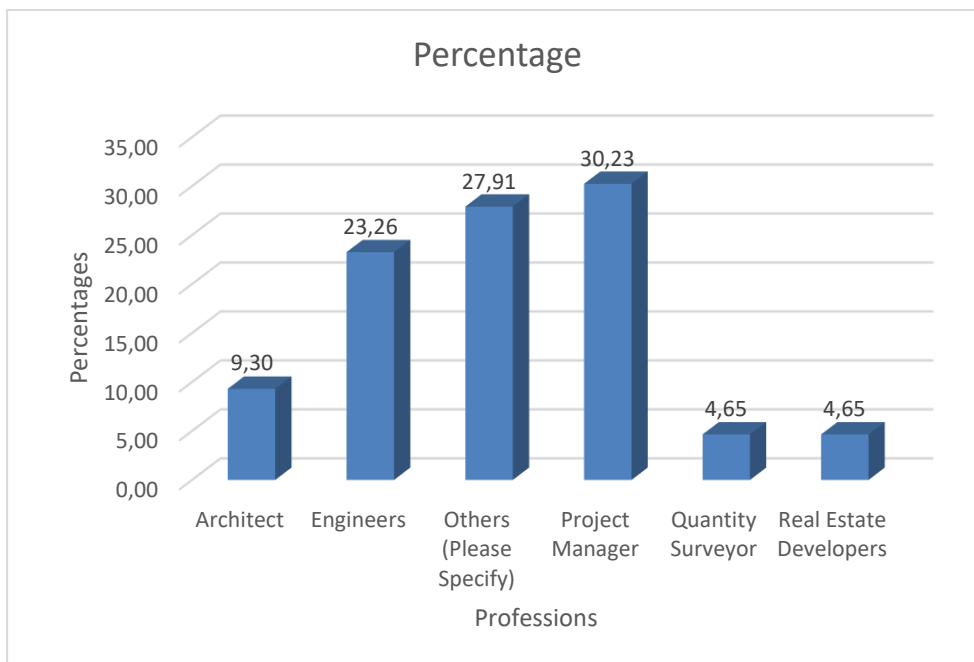
**Figure 16.** Education level of developers<sup>24</sup>

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<sup>24</sup> Author

#### 4.5.4 Developers/ Professionals current position

From Figure 17, there were 30.2% of developers who identified themselves as project managers, making this the most common job title. At 23.3%, engineers are the second biggest occupation in the country. 9.3 percent of those polled work in architecture, followed by 4.7 percent each from quantity surveyors and real estate developers. Additionally, 27.9% of respondents selected "Other," and they were given the option to provide further detail on their occupation. These results help shed light on the make-up of the study's developer workforce by revealing the distribution of developer roles among those who took part in the survey.



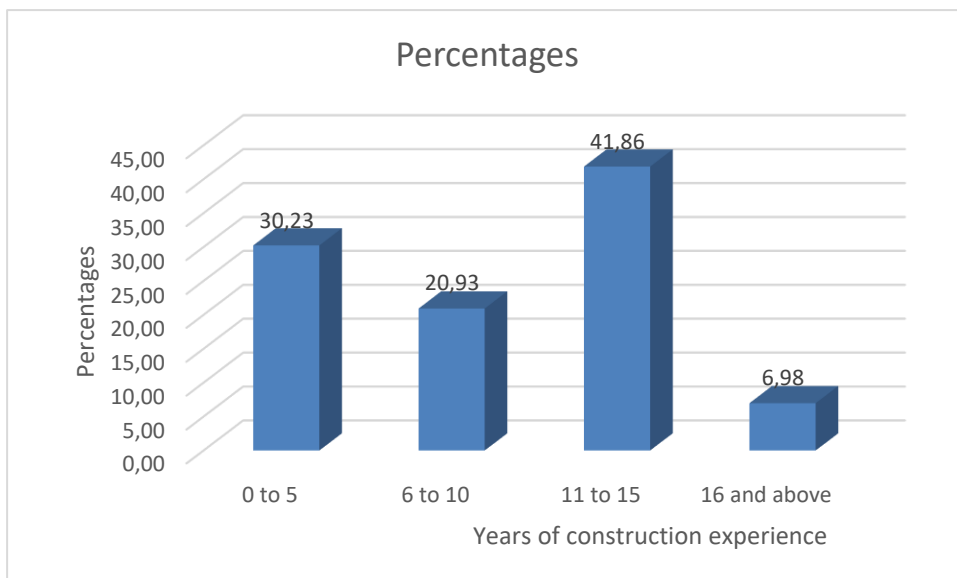
**Figure 17.** Distribution of developer occupations<sup>25</sup>

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<sup>25</sup> Author

#### 4.5.5 Experience of Developers

According to Figure 18, a significant proportion of the surveyed developers, amounting to 41.9% of the participants, reported having 11-15 years of experience. The subsequent most sizable cohort comprised individuals possessing 0-5 years of professional experience, constituting 30.2% of the sample. The survey results indicate that individuals with 6-10 years of experience in development comprised 20.9% of the respondents, whereas those with 16 years or more of experience represented 7.0% of the survey participants. This data offers valuable perspectives on the dispersion and proficiency levels of the surveyed developers. Assessing the proficiency and experience of the participants can prove advantageous in comprehending their contributions.



**Figure 18.** Experience of developers<sup>26</sup>

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<sup>26</sup> Author

#### **4.6 Section B- sustainability and use of container housing for student accommodation.**

The initial question garnered a considerably high mean and Relative Importance Index (RII), suggesting that it holds significant sway in determining the acceptability of domiciliary structures fashioned from shipping containers vis-à-vis conventional construction techniques. According to the ratings provided by the respondents, it was ranked as the 6th most important factor.

The second factor garnered a comparatively lower mean and RII in relation to the other factors, thereby suggesting that it is deemed less impactful in ascertaining the acceptability of shipping container housing. According to the ratings provided by the respondents, it was ranked as the 7th most important factor.

The third factor obtained a high average and Relative Importance Index (RII), indicating its significant role in fostering sustainable lifestyle behaviors in relation to student housing constructed from shipping containers. According to the ratings provided by the respondents.

The fourth factor garnered a relatively high mean and RII, signifying its perceived significance in mitigating the ecological footprint of shipping container housing by means of waste and recycling management. According to the ratings provided by the respondents, it was ranked as the second most important factor.

The fifth factor garnered the highest mean and RII, signifying its significant impact on the acceptability of shipping container housing. According to the ratings provided by the respondents, the topmost priority is given to the efficient reduction of water consumption during the construction process.

The sixth factor garnered a significantly elevated mean and RII, signifying the perceived significance of sustainability in the context of student housing utilizing shipping container architecture. Based on the ratings provided by the respondents, it was determined that this factor held the second highest level of importance, with an equivalent ranking to the preceding factor.

In summary, based on the analysis of the questionnaire output using RII, mean, and position, the factors that were rated as most influential in determining the acceptability of shipping container housing for students are:

1. During construction, water usage is effectively minimized to conserve water.



2. Waste and recycling management in shipping container housing minimizes their environmental impact.

3. Shipping container housing, when made energy efficient, promotes sustainable living practices for students.

Factors such as the sustainability of materials used, the perception of housing as a more sustainable option compared to traditional construction methods, and the importance of sustainability in student accommodation using shipping container housing were also considered but were rated slightly lower in terms of importance.

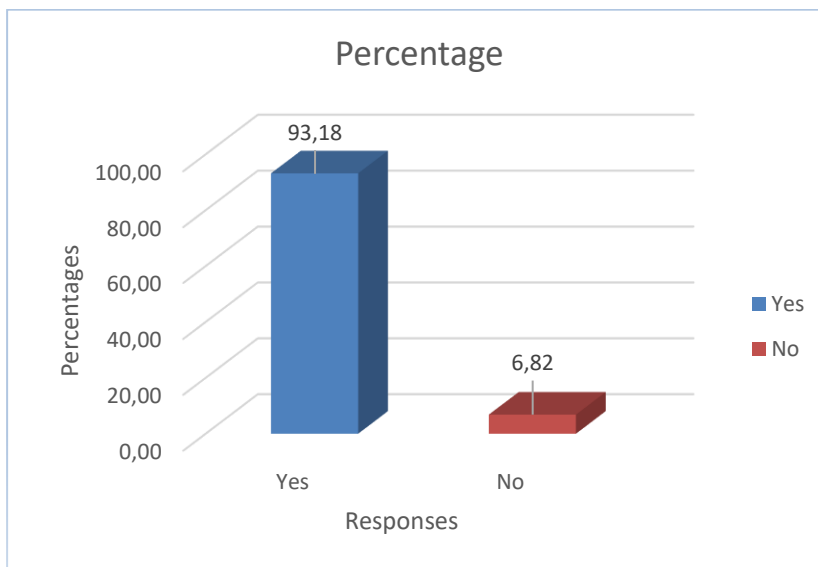
Table 5 offers valuable perspectives regarding the determinants that impact the level of acceptability towards the utilization of shipping container housing among the participants. This data can be utilized to prioritize and concentrate on the most significant variables while conducting further investigation and analysis of the acceptability of shipping container housing in student housing.

s/no	Factors that influence acceptability	Frequency of response					$\Sigma f$	$\Sigma fx$	Mean	RII	Position
		1	2	3	4	5					
1	Housing made with shipping containers are more sustainable option than student accommodation made from traditional construction method	4	3	11	13	12	43	155	3,60	0,72	6th
2	Materials used in Shipping container housing are sustainably sourced and environmentally friendly	3	7	10	12	10	42	145	3,45	0,69	7th
3	Shipping container housing when made energy efficient promotes sustainable living practices for students	0	4	6	12	19	41	169	4,12	0,82	4th
4	Waste and recycling management in shipping container housing minimizes their environmental impact	0	3	3	15	21	42	180	4,28	0,85	2nd
5	During construction, water usage is effectively minimized to conserve water	2	1	2	14	22	41	176	4,29	0,86	1st
6	Sustainability is important when considering student accommodation using shipping container housing	1	0	5	16	20	42	180	4,28	0,85	2nd

**Table 5:** Factors that influence acceptability for students<sup>27</sup>

#### 4.6.1 Developers level of familiarity with shipping container housing

Participants' understanding of the idea of shipping container dwelling was assessed by this question. From Figure 19, 93% of the respondents said they were aware of the idea, while only 6.82 percent said they were not. According to the findings, most survey respondents were aware of shipping container housing, indicating that Nigerians have had some exposure to this type of dwelling.



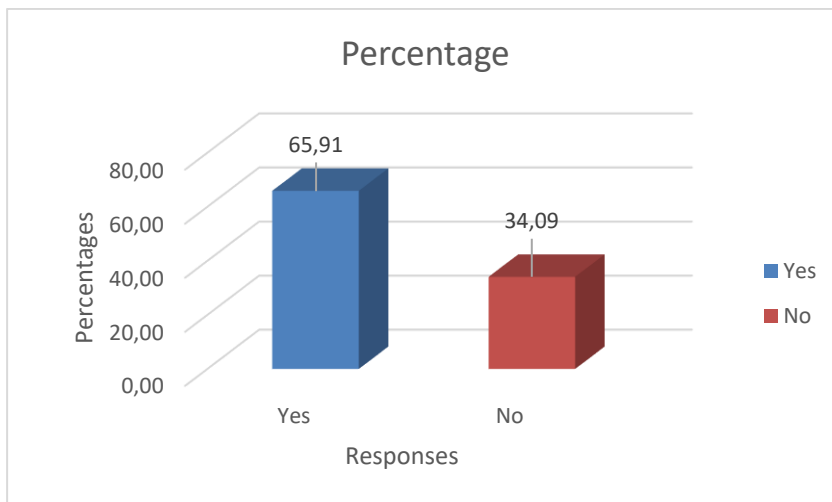
**Figure 19.** Students level of familiarity with shipping container housing<sup>28</sup>

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<sup>28</sup> Aurhor

#### 4.6.2 Awareness of shipping container housing development in the states

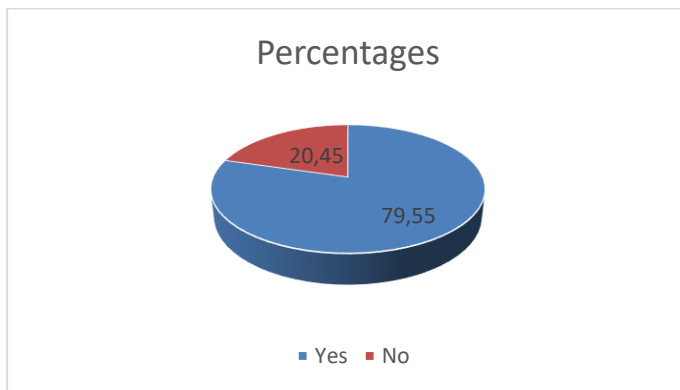
Figure 20 shows 65.91% of responders to this question were aware that housing developments using shipping containers were occurring in their state. This suggests a high level of experience and awareness with this alternate housing option. 34.09% of the participants, however, claimed to be unaware of such developments. This shows that there is still opportunity for increasing public understanding of container houses' advantages and opportunities in Nigeria.



**Figure 20.** Awareness of shipping container housing development in the states<sup>29</sup>

#### 4.6.3 The principle of sustainable production and consumption, and shipping container house as student accommodation

Respondents were asked if they believed that the principle of sustainable production and consumption is embraced when using shipping container housing for student accommodation, and they responded in the order as shown in Figure 20. This outcome shows that a sizable majority, 79.55%, thinks that using shipping container homes as student housing upholds the idea of sustainable production and consumption. These participants are aware of the potential resource savings and environmental advantages of converting shipping containers into homes. A minority, or 20.45%, do not hold this opinion.



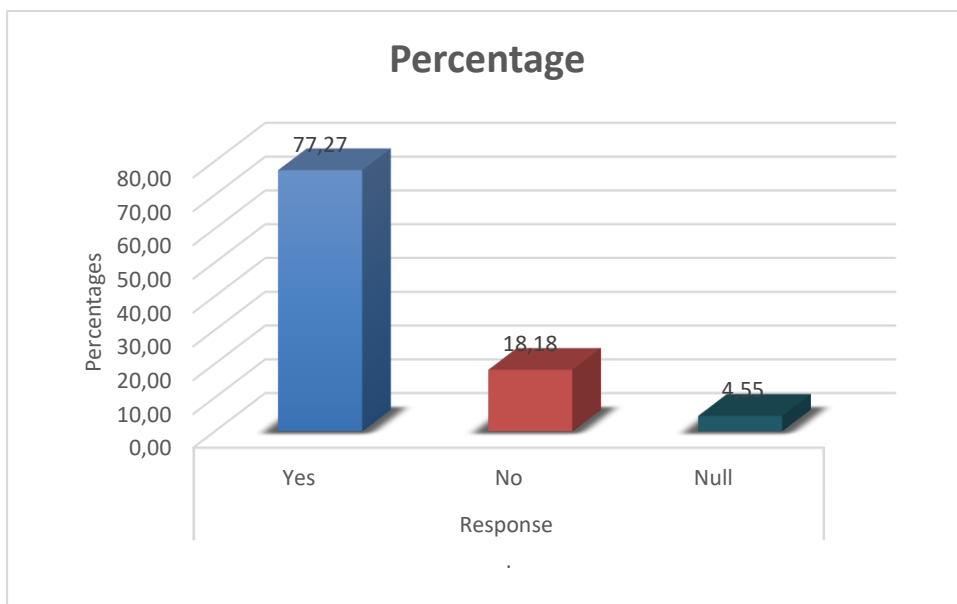
**Figure 20.** Belief in sustainable production and consumption in shipping container housing for student accommodation<sup>30</sup>

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<sup>30</sup> Author

#### 4.7 Developers opinion on sustainability prospect on container housing for student accommodation

The developers/ professionals were asked about their opinion on the principle of sustainable production and consumption in relation to the use of shipping container housing as student accommodation, and their response is tabulated below in a bar chart. Figure 21 shows the use of shipping containers as student housing and the idea of sustainable production and consumption reveal a favorable reaction. A majority of respondents roughly 77.27% said they agreed with the idea, indicating that people have a positive view of sustainable behaviours. Contrarily, 18.18% of participants disagreed, and a smaller percentage, 4.55%, remained indifferent or did not offer a clear answer. These results show that employing container homes as a long-term option for student housing in Nigeria has a substantial amount of acceptance and promise.



**Figure 21:** Respondent opinion on Sustainable production and consumption<sup>31</sup>

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<sup>31</sup> Author

#### **4.7.1 Drivers that influence developers' choice of investing in shipping container housing**

The developers and professionals that were part of the respondents were asked to respond to set of drivers that influence their choice of investing or selecting the option of shipping container housing for student accommodation, and the ranked it on a scale of 1-5 as shown in Table 6. Their responses revealed that “construction timeline” as a consideration for the shipping container housing was their topmost priority and hence ranked 1st on the list of drivers with a relative importance index of 0.87. The respondent rated the driver “Sustainable construction practice” 2nd with a relative importance index of 0.86. It is evident that construction timelines hold great significance in the industry, as many projects struggle to meet their delivery deadlines. Additionally, the importance of sustainability has been increasingly recognized and embraced by construction professionals and developers, as its benefits become more apparent. This has led to a growing advocacy for sustainable construction practices.

The respondents further ranked the flexibility in design customization when used for student accommodation 3rd with an RII of 0.84, also new and innovative construction method was on the same rank level with RII of 0.84. Last on the list of ranking with an RII of 0.77 was the ability of shipping container housing to produce sustainable housing though the RII of 0.77 showed that is also a very significant consideration.

	Drivers	Responses					$\Sigma f$	$\Sigma fx$	Mean	RII	Position
		1	2	3	4	5					
1	How likely are you <sup>32</sup> to consider shipping container housing as a viable option for student accommodation development in the near future	0	1	10	17	13	41	165	4,02	0,80	9th
2	To what extent do you believe that shipping container housing could potentially provide a more cost-effective solution for student accommodation development	1	1	9	16	17	44	179	4,07	0,81	7th
3	How important is it for you to consider sustainable construction practices in your student accommodation developments	0	2	3	14	19	38	164	4,32	0,86	2nd
4	To what extent do you believe that shipping container housing could potentially offer greater flexibility in design and customization options for student accommodation developments?	1	0	6	14	18	39	165	4,23	0,84	3rd
5	How important is it for you to consider providing affordable student accommodation options to the market?	0	3	6	18	17	44	181	4,11	0,82	6th
6	How much weight do you place on reducing construction timelines in your student accommodation developments?	0	1	7	10	22	40	173	4,33	0,87	1st
7	To what extent do you believe that the unique aesthetics of shipping container housing could provide a competitive edge in the student accommodation market?	1	2	9	14	13	39	153	3,92	0,78	10th
8	How much weight do you place on the ability of shipping container housing to provide sustainable housing solutions for students?	0	4	11	16	13	44	170	3,86	0,77	11th
9	How likely are you to consider shipping container housing as a way to address the current housing shortage for students in your area?	0	3	8	16	17	44	179	4,07	0,81	7th
10	How important is it for you to consider new and innovative construction methods in your student accommodation developments?	0	3	4	13	19	39	165	4,23	0,84	3rd
11	The need to integrate traditional architecture, and ornamental features in the building.	1	1	5	20	15	42	173	4,12	0,82	5th

**Table 6:** Drivers that influence developers' choice of investing in shipping container housing<sup>33</sup>

<sup>33</sup> Author



#### **4.7.2 Factors that Contribute to hidden expenses over the lifecycle of shipping container housing**

The highest mean (4.33) and Relative Importance Index (0.87) were given to the requirement for insulation and ventilation systems as seen in table 7, showing that these factors have a big impact on security in container dwellings. It was deemed to be the most crucial element. In order to keep a home safe and comfortable, insulation and ventilation systems are essential.

A high mean (4.29) and Relative Importance Index (0.86) were reported for the need for an expert in design and construction, showing its perceived importance in guaranteeing security in container homes. It was listed as the second most crucial element. It is easier to assure structural integrity and compliance with safety regulations by employing specialists for design and construction.

The necessity of hiring experts for repairs and improvements had a Relative Importance Index of 0.85 and a mean that was reasonably high, indicating its significance in preserving security in container homes. It was listed as the third most crucial element. Any security flaws are properly handled when specialists are hired for repairs and improvements.

Table 7 revealed that the need for insulation and ventilation systems, the requirement for professional design and construction, and the necessity of hiring experts for repairs and improvements were the factors that were rated as most influential in determining security in container homes in Nigeria. These elements emphasize how crucial it is to use sound design, building, and maintenance techniques to guarantee the security of container houses.

S/No	Factors	Responses					$\Sigma f$	$\Sigma fx$	Mean	RII	Position
		1	2	3	4	5					
1	Regular maintenance and inspections	2	3	7	17	15	44	172	3,91	0,78	6th
2	Insurance to protect yourself from risk	0	3	11	19	10	43	165	3,84	0,77	7th
3	Implementing suitable security and safety measures	0	3	8	15	15	41	165	4,02	0,80	5th
4	Employ experts when necessary to make repairs and improvements	1	1	6	15	21	44	186	4,23	0,85	3rd
5	An extensive inspection of shipping containers before purchase.	0	5	6	13	20	44	180	4,09	0,82	4th
6	The need for insulation and ventilation systems.	0	4	3	10	25	42	182	4,33	0,87	1st
7	Need for expert in design and construction.	0	2	6	11	22	41	176	4,29	0,86	2nd

**Table 7:** Factors that Contribute to hidden expenses over the lifecycle of shipping container housing<sup>34</sup>

#### 4.7.3 Benefits associated with using shipping container housing for student accommodation.

Quick to Construct: Table 8 shows feature's highest mean and RII values of 4.4 and 0.88 respectively show that it is regarded as the most crucial element influencing security in container houses. It implies that respondents place a high value on building speed and that this value significantly influences respondents' perceptions of how acceptable container houses are. Faster occupancy and less exposure to security threats during construction are two benefits of quick construction.

Cost-effectiveness scored a high mean and RII of 4.2 and 0.84 respectively despite coming in second in terms of relevance. Cost-effectiveness is seen as an important factor in container houses, suggesting that cost influences whether or not this housing design is acceptable. It implies that respondents saw cost-saving advantages as enhancing security by facilitating access to homes.

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<sup>34</sup> Author

Environmentally friendly: Although this criterion scored a reasonably high mean and RII, it was rated third in terms of relevance. It shows that respondents regard container houses' environmental friendliness and that it affects how secure they feel. This shows that using environmentally friendly and sustainable methods while building container homes enhances the general safety and wellbeing of tenants.

s/no	Benefits associated with shipping container housing system	Responses					$\Sigma f$	$\Sigma fx$	Mean	RII	Position
		1	2	3	4	5					
1	Cost-effective	0	2	7	15	20	44	185	4,20	0,84	2nd
2	Environmentally friendly	0	4	6	14	19	43	177	4,12	0,82	3rd
3	Easily transportable	0	4	7	15	18	44	179	4,07	0,81	4th
4	Quick to construct	0	2	3	13	24	42	185	4,40	0,88	1st
5	Durable	0	4	10	15	16	45	178	3,96	0,79	5th

**Table 8:** Benefits associated with shipping container housing system<sup>35</sup>

#### 4.8 Chapter summary

Chapter 4 analyzed data and designed a questionnaire to evaluate shipping container housing for student hostels' sustainability. Participants were divided into students and construction professionals. We aimed for 140 responses, evenly split between the two groups.

A significant response was received from both students and professionals for the study on container housing for student accommodation in Nigerian tertiary institutions. Analysis of the collected data provided valuable insights into the suitability, feasibility, and potential benefits of using container housing options. Based on findings, it conclusions were made on the viability of shipping container housing for student accommodation.

Chapter 5 analyzed research findings and questionnaire evaluation to explore how professionals and students view container housing as student housing. Constraints will be examined, implications of findings discussed, and suggestions made for future research. Chapter 6 will presented significant findings, draw conclusions, and suggested future-oriented ideas

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<sup>35</sup> Author

## **Chapter 5: Discussion of Results and Justification**

### **5.1 General Information**

This chapter gives an overview and indepth discussion of the outcome of chapter 4, while referring to the exiting literatures concerning shipping container housing and the successes recorded, it also establishes linkage to the use of shipping container housing for of student accommodation purpose.

### **5.2 Discussion of Finding and Justification of Research Questions**

The analysis of result in chapter 4 section 4.3.2 revealed an above average awareness about the concept of shipping container housing among the students, with about 66% being aware of the concept while the remaining 34% are not aware of the use of shipping container housing for residential purpose. Furthermore section 4.6.2 revealed that professionals/Developers are fully aware of the concept of shipping container housing being used for the purpose of residential accommodation, out of which 79.55% believe that the use of shipping container housing for the purpose of student accommodation embraces the concept of sustainable production and consumption which is the UN goal 12.

#### **5.2.1 RQ 1: What are the underlying benefits of using shipping container housing for student accommodation?**

Many literatures have expressly discussed the concept of shipping container housing, the advantages and disadvantages of using shipping container housing for residential purposes, and some talked about the successes recorded in using shipping container housing in cold regions of the world. Regardless of these successes recorded, not much has been written about the use of shipping container housing for student accommodation in warm regions of the world especially in Nigeria, where there is an acute shortage of student accommodation and an ample supply of containers. To this end, a set of questions were developed that borders on the benefits accruable by using shipping container housing for residential purpose, and students were asked to rank these set of benefits on a scale of priority.

Students ranked the benefit “Quick to construct” first 1st next in the second position of the ranking is “ease of transporting”. Least on the table of the 5 factors mentioned here is “Cost effective”. This is in line with the assertion made by (Gouna et al., 2017) stating that the modularity of shipping container is a reason for their use as housing skeleton and this makes it easy and fast to construct. He further stated that another major reason for their use in housing is the ease in transporting units of the shipping container which are then used for the purpose of housing construction.

### **5.2.2 RQ 2: What is the level of acceptability among students regarding use of shipping container housing for accommodation?**

The selected set of respondents who are student’s resident in Abuja and Lagos were asked if they think the use of container housing could solve the acute student accommodation challenge faced in tertiary institutions, about 70% of them responded in the affirmative, stating that they believe it could be a sustainable solution. 10% of the respondents said “No” to imply that shipping container housing was not a sustainable solution, while about 19% chose the option of “maybe”. The above statement shows that a great percentage believe that shipping container housing is a sustainable route to tackle accommodation deficit. Furthermore, when presented with a list of factors that influence their choice of a shipping container housing, security was ranked first and the next was location and accessibility, This may be attributed to the points reeled out by Olanrewaju et al., (2022) where he pointed out that in the middle of the 1980s, acute problem in student housing in Nigerian tertiary institutions gave way to off campus dwellings, and these were associated to insecurities, epileptic water and electricity supply, coupled with ineffective municipal transport system. Hence the pattern of ranking of the Relative Importance Index observed here.

### **5.2.3 RQ 3: What is the stakeholders and developers’ level of interest in venturing into shipping container housing for the purpose of student accommodation?**

The results of Chapter 4 evaluated the stakeholders' and developers' interest in pursuing shipping container housing for student housing. It showed that the respondents' top priority was the schedule for construction. This demonstrates that stakeholders and developers value the ease of container house building, which is consistent with the

conclusions covered in the previous question. The significance attached to on-time project delivery in the construction business is shown by the relative importance index of 0.87 ascribed to the construction timeline. The outcome also shows that respondents placed sustainable construction techniques second, demonstrating a rising understanding of the priority given to sustainability in the construction sector. This is consistent with the larger body of literature on sustainable housing, where the use of sustainable techniques has become more prominent.

Sustainable construction methods aid in resource conservation, energy efficiency, and environmental protection, according to Grigoreva (2019). This is in line with the goals of container dwelling since it could lessen environmental impact and encourage sustainable living. The results also back up the research of Haque et al. (2021), who stressed the significance of sustainable building methods in the development of Nigerian housing. The emphasis on the building schedule also reflects the necessity to deal with the difficulties of delays and project overruns that are frequently encountered in the construction sector. Ojoko et al. (2016) assert that Nigerian building project delays are a major cause for concern. Container housing may be able to solve this issue thanks to its potential for quicker construction.

#### **5.2.4 RQ 4: What is the sustainable production and consumption of shipping containers?**

An essential goal of the study on container housing for students in Nigeria was to assess the sustainability of shipping container production and usage. The results of the questionnaire analysis offered important new perspectives on the variables affecting the acceptance of shipping container housing and its sustainability features. The findings showed that aspects including reducing water use during construction, managing waste and recycling, and energy efficiency were considered as the most important in determining whether shipping container housing was acceptable to students. As they deal with resource efficiency, waste reduction, and mitigating environmental effect. These variables are consistent with the ideas of sustainable production and consumption.

Literature on container architecture and sustainable housing might be cited as evidence for these conclusions. As an illustration, Taleb et al. (2019) stressed the significance of sustainable methods in container home building, such as resource efficiency

and waste management. This is consistent with the factors that the questionnaire's results found. Additionally, Frazelle (2016) talks about how container housing could help to promote sustainable living and student wellbeing. They underline the advantages of eco-friendly materials and energy-efficient designs, which are factors emphasized in the questionnaire analysis. These research citations back up the questionnaire analysis's findings and show the characteristics that were identified as important in the context of student housing in sustainable containers. The research can build a solid foundation for assessing the sustainable production and consumption elements of shipping container housing in Nigeria by incorporating these findings and making use of pertinent literature.

### **5.3 Implication of the study**

The research shows that shipping container housing has the potential to be a workable and long-term solution to the severe lack of student housing. This gives student the chance to live in cheap, environmentally friendly and tastefully constructed housing units. This research also sheds light on the increased acceptance and interest in shipping container housing for developers and other industry participants (Haque, 2021). The relevance of integrating eco-friendly practices in housing development is highlighted by prioritizing building timeframe and sustainable construction methods. This could serve as a roadmap for developers as they embrace resource-saving and environmentally friendly construction practices.

Furthermore, by comprehending the potential policy consequences of shipping container housing for student housing, policymakers and government authorities can gain from this study. Policymakers can promote the widespread use of shipping container housing and alleviate the housing issues encountered by students by expediting approval procedures, offering incentives, and creating policies that support sustainable construction methods. The findings have broader ramifications for the sustainable housing industry. The necessity of adopting sustainable practices in house design and construction is highlighted by the emphasis on resource conservation, waste management, and energy efficiency (Grigoreva, 2019). As a result, more people can be encouraged to live sustainably and help the environment. Overall, this study has implications for students, developers, legislators, and the field of sustainable housing,

providing possibilities, insights, and potential solutions to the pressing problem of student housing while promoting sustainability goals.

#### **5.4 Limitation of Study**

The study's exclusive focus on the Nigerian environment limited how far the results can be applied to other areas or nations. In other situations, the specific social, economic, and cultural characteristics of Nigeria might have a distinct impact on the acceptability and viability of shipping container housing (Balogun, 2018). As a result, care should be taken when extrapolating this study's conclusions to other geographical areas. Additionally, students, stakeholders, and developers generally provided self-reported replies to surveys, which served as the research's main data source. This strategy is vulnerable to possible response biases including social desirability bias or a lack of comprehension of the research topics (Hong, 2017). The perceptions of the participants, which could not accurately reflect their actions or intentions, could have an impact on the results.

The study also concentrated primarily on the viewpoints and impressions of students, stakeholders, and developers. The research did not fully involve other significant stakeholders like local communities, public officials, and facility managers. Their thoughts and insights could have contributed to a more thorough understanding of the benefits and problems associated with shipping container housing for students (Fteng, 2022). Additionally, the study focused primarily on the advantages, acceptability, and sustainability aspects of shipping container housing and did not go into great detail about any potential downsides or constraints. Further study is required to fully understand factors including long-term upkeep, social integration, and architectural limits. These factors were not fully investigated in this study.

Last, the study's constrained schedule and financial resources might have hampered its extent and depth. It would have been possible to gain deeper understanding of the real-world application and lived experiences of shipping container housing for students by conducting on-site observations, in-depth interviews, or case studies (Idiang et al., 2022). Despite these drawbacks, this study offers a useful starting point for more investigation and actual application of shipping container housing for student housing. In order to develop a more comprehensive understanding of the potential of shipping



container housing in various circumstances, future studies might build on this research by resolving the stated constraints and researching new areas.

## **Chapter 6: Conclusions and Recommendations**

### **6.1 General Information**

Based on the facts covered in the other chapters, Chapter 6 presents recommendations for future activities and delivers a thorough conclusion. This chapter intends to provide stakeholders and researchers interested in the topic of shipping container housing for students with a useful summary of the main ideas, an explanation of the significance of the research, and practical advice.

### **6.2 Conclusions**

This study's investigation into the possibility of shipping container housing for student housing, particularly in Nigeria, was its primary goal. Upon study of the data, four crucial conclusions were drawn:

- Students are notably aware of the idea of shipping container dwelling. Many students voiced the opinion that the severe lack of student housing may be alleviated using shipping containers for housing. Students' awareness of the issue and favourable impression of it lay a strong platform for future research on and use of shipping container housing in Nigeria.
- Interested parties and developers have expressed a strong desire to explore the possibility of using shipping containers as student housing. The emphasis placed on construction schedules and environmentally friendly building methods illustrates how sustainability is becoming increasingly recognized in the construction industry. This fits in with the greater body of research on sustainable housing and offers a chance to encourage green practices in the housing sector.
- Important elements like water conservation, waste management, and energy efficiency were highlighted in the assessment of the sustainable manufacture and consumption of shipping containers. These results highlight the importance of including sustainable practices in the planning, building, and maintenance of shipping container housing. Reduce environmental impact and encourage sustainable living by using eco-friendly materials and energy-efficient designs.

- From the benefits, shipping container housing has the ability to offer a workable and long-term solution to the problem of student housing in Nigeria. Shipping container housing is a viable alternative because of its quick construction, simplicity in transportation, and capacity for sustainable practices.

### **6.3 Recommendations**

- Further study is required to examine the long-term sustainability, social impact, and user satisfaction of shipping container housing for student housing given its relative novelty (Azeez et al., 2016). Future research should concentrate on evaluating the robustness, thermal performance, and general livability of shipping container housing in various climates.
- The government and related authorities ought to think about establishing laws and rules that make it easier to use shipping containers as student housing, this could entail expediting the approval procedures, offering incentives for eco-friendly building techniques, and guaranteeing adherence to building codes.
- To test and implement shipping container housing projects, stakeholders such as academic institutions, military institutions, real estate investors, and nonprofit organizations should work together to ensure successful implementation and deal with any potential difficulties, these partnerships can make use of the knowledge and resources of other organizations.
- The promotion of sustainable housing practices and the planning of awareness campaigns to allay any misunderstandings or worries can be greatly aided by educational institutions.
- Establishing a framework for monitoring and evaluating shipping container housing projects is essential for determining their effectiveness and impact to ensure ongoing success and continuous progress, this will aid in identifying areas for improvement, measuring energy efficiency, and gathering resident input.
- Access to funds can aid in overcoming financial obstacles and encourage more developers to make investments in environmentally friendly options for student housing.

## Declaration of Authorship

I hereby declare that the attached Master's thesis was completed independently and without the prohibited assistance of third parties, and that no sources or assistance were used other than those listed. All passages whose content or wording originates from another publication have been marked as such. Neither this thesis nor any variant of it has previously been submitted to an examining authority or published.

Berlin, 07.07.2023

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Location, Date

A handwritten signature in blue ink, appearing to be 'Kerim', written over a horizontal line.

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Signature of the student

## **Consent of publishing the Master`s Thesis**

This page of the Master`s Thesis is optional. If you agree to publish the Master`s Thesis at the HTW Berlin library after a successful Final Oral Examination, then you should also attach the relevant formula here.

## Appendix

### Questionnaire

#### Part 1: For students

Dear respondent

QUESTIONNAIRE ADMINISTERED TO EXPLORE THE VIABILITY OF SHIPPING  
CONTAINER HOUSING AS A SOLUTION TO STUDENT HOUSING DEFICIT IN  
NIGERIA.

Thank you for participating in this research titled "Exploring the viability of shipping container housing as a solution to student housing deficit in Nigeria". Your valuable input will help to gain a better understanding of stakeholders' perceptions of using shipping container housing for student accommodation.

This questionnaire should take approximately 10-15 minutes to complete, and all responses will be kept confidential. I appreciate your time and contribution to this study.

#### Section A- General information about the respondent (Student)

1. Gender:
  - a) Male
  - b) Female
  - c) Other (Please specify) \_\_\_\_\_
  
2. Age:
  - a) 16-25
  - b) 26-35
  - c) 36-45
  - d) 45 and above
  
3. Educational level:
  - a) National Diploma/ Higher National Diploma
  - b) Bachelor's Degree
  - c) Post-graduate diploma
  - d) Master's Degree

e) Doctorate

4. What type of student accommodation have you lived in?

- a) Single-bed accommodation
- b) Shared apartment
- c) Off-Campus Housing
- d) Other (Please specify) \_\_\_\_\_

5. What was/is the building made of

- A) Traditional construction material or
- B) Modular (Shipping container) material?

6. Did you have the liberty to choose the accommodation type or Building?

- a) Yes
- b) No

### **Section B: Student Acceptability of the concept of Container Housing**

1. Are you acquainted with houses made from shipping containers?

- a) Yes
- b) No

2. Have you stayed in such accommodation?

- a) Yes
- b) No

3. To what extent do you agree that the following are the benefits of creating student housing out of shipping containers? On a scale of 1-5 (1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree, 5-Strongly agree)

<b>S/No</b>	<b>Benefits associated with shipping container housing system</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
1	Cost-effective					
2	Environmentally friendly					
3	Easily transportable					
4	Quick to construct					
5	Durable					

4. Do you think container housing can help to solve the student accommodation deficit in universities?
- Yes
  - No
  - Maybe
5. How significant are the following factors when considering whether to live in a shipping container as a kind of student housing?

<b>s/no</b>	<b>Factors</b>	<b>Not important</b>	<b>Some-what important</b>	<b>Neu-tral</b>	<b>Im- portant</b>	<b>Ex- tremely im- portant</b>
a	Rental Cost					
b	Environmental sustainability					
c	Location and accessibility					
d	Security					
e	Space and comfort					



f	Standard of amenities					
g	Energy-efficient design					

Ref: The influence of socio-economic characteristics on satisfaction in selected university hostels

6. Do you think living in a shipping container house for student would have hidden expenditures like upkeep and risk obligation for structural integrity?
  - a. Yes
  - b. No
  - c. I am not sure.
7. Do you believe that the principle of sustainable production and consumption is embraced by the usage of shipping container house as student housing?
  - a. Yes
  - b. No

## Part 2 For Construction Professionals and Developers

Dear respondent

QUESTIONNAIRE IS ADMINISTERED TO EXPLORE THE VIABILITY OF SHIPPING CONTAINER HOUSING AS A SOLUTION TO STUDENT HOUSING DEFICIT IN NIGERIA.

Thank you for participating in this research titled "Exploring the viability of shipping container housing as a solution to student housing deficit in Nigeria". Your valuable input will help to gain a better understanding of stakeholders' perceptions of using shipping container housing for student accommodation.

This questionnaire should take approximately 10-15 minutes to complete, and all responses will be kept confidential. I appreciate your time and contribution to this study.

### Section A: General Information

1. Gender:
  - a) Male
  - b) Female
  - c) Other (Please specify) \_\_\_\_\_
  
2. Age:
  - a) 16-25
  - b) 26-35
  - c) 36-45
  - d) 45 and above
  
3. Educational level:
  - a) National Diploma/ Higher National Diploma
  - b) Bachelor's Degree
  - c) Post-graduate diploma
  - d) Master's Degree
  - e) Doctorate
  
4. What is your current job position?
  - a) Architect
  - b) Engineer
  - c) Project Manager
  - d) Real estate developer
  - e) Other (Please specify) \_\_\_\_\_
  
5. How many years of experience do you have in your field?

- a) 0-2 years
- b) 3-5 years
- c) 6-10 years
- d) 11-15 years
- e) 16 or more years

### Section B- Sustainability and Use of Container Housing for Student Accommodation

1. Are you familiar with the concept of shipping container housing?
  - a. Yes
  - b. No
2. Are you aware of shipping container housing development in your state?
  - a. Yes
  - b. No
3. Do you believe that the principle of sustainable production and consumption is embraced by using shipping container house as student accommodation?
  - a. Yes
  - b. No
4. On a scale of 1 to 5, (1- strongly disagree, 2-Disagree, 3- Neutral, 4-Agree, 5- Strongly agree) kindly rank to what extent do you agree with the following sustainability features regarding shipping container housing

s/no	Sustainability	1	2	3	4	5
1	Housing made with shipping container are more sustainable option than the traditional student accommodation construction method					
2	Materials used in Shipping container housing are sustainably sourced and environmentally friendly					
3	Shipping container housing when made energy efficient promotes sustainable living practices for students					
4	Waste and recycling management in shipping container housing minimises their environmental impact					
5	During construction, water usage is effectively minimised to conserve water					
6	Sustainability is important when considering student accommodation using shipping container housing					

### SectionC – Developers opinion on sustainability prospect on container housing for student accommodation

1. Do you believe that the principles of sustainable production and consumption is embraced by using shipping container housing as student housing?
    - a. Yes
    - b. No
    - c. I am not sure.
  2. What kind of corporation or partnership are you interested in exploring to develop student accommodation out of shipping container? (Open ended)
- 

3. Please rate the level of importance attached to each of the following drivers in affecting developers' choice of investing in shipping container housing over traditional housing. On a scale of 1-5, (1) Extremely unimportant (2) Unimportant (3) Neutral, (4) Important (5) Extremely important

s/no	Drivers	1	2	3	4	5
1	How likely are you to consider shipping container housing as a viable option for student accommodation development in the near future.					
2	To what extent do you believe that shipping container housing could potentially provide a more cost-effective solution for student accommodation development					
3	How important is it for you to consider sustainable construction practices in your student accommodation developments					
4	To what extent do you believe that shipping container housing could potentially offer greater flexibility in design and customization options for student accommodation developments?					
5	How important is it for you to consider providing affordable student accommodation options to the market?					
6	How much weight do you place on reducing construction timelines in your student accommodation developments?					
7	To what extent do you believe that the unique aesthetics of shipping container housing could provide a competitive edge in the student accommodation market?					
8	How much weight do you place on the ability of shipping container housing to provide sustainable housing solutions for students?					
9	How likely are you to consider shipping container housing as a way to address the current housing shortage for students in your area?					

10	How important is it for you to consider new and innovative construction methods in your student accommodation developments?					
11	The need to integrate traditional architecture, and ornamental features in the building.					

### Section D: Importance, durability and measures for the adoption of container housing for student accommodation

1. On a scale of 1-5 (1) Extremely unimportant (2) Unimportant (3) Neutral, (4) Important (5) Extremely important how would you rank the following features in influencing your choice of a shipping container house for student accommodation.

S/No	Benefits associated with shipping container housing system	1	2	3	4	5
1	Cost-effective					
2	Environmentally friendly					
3	Easily transportable					
4	Quick to construct					
5	Durable					

2. On a scale of importance from 1 to 5 (1) Extremely unimportant (2) Unimportant (3) Neutral, (4) Important (5) Extremely important, how do you assess these factors that contribute to hidden expenses over the lifecycle of a shipping container housing for student accommodation?

s/no	Factors	1	2	3	4	5
1	Regular maintenance and inspections					
2	Insurance to protect yourself from risk					
3	Implementing suitable security and safety measures					
4	Employ experts when necessary to make repairs and improvements					
5	An extensive inspection of shipping containers before purchase.					
6	The need for insulation and ventilation systems.					
7	Need for expert in design and construction.					

3. Based on your experience, suggest measures that can enhance the adoption of container housing for student housing.

## References

- Adama, J. U., Aghimien, D. O., & Fabunmi, C. O. (2018). Students' housing in private universities in Nigeria: influencing factors and effect on academic performance. *International journal of built environment and sustainability*, 5(1). 10.11113/ijbes.v5.n1.242
- Adesola, A. O. (2019). The Nigerian university system: meeting the growth challenges in a depressed economy. *Higher Education*, 21(1), 121–133. <https://doi.org/10.1007/bf00132345>
- Adewale, A. S., & Zubaedy, A. A. G. (2019). Islamic finance instruments as alternative financing to sustainable higher education in Nigeria. *Global Journal Al-Thaqafah*, 9(1), 35-48.
- Aigbiremolen, A. O., Lawal-Luka, R. K., Abejegah, C., Aigberemwon, J. A., Abah, E. O., & Abah, S. O. (2017). Environmental risk factors in the transmission of Lassa fever in college students hostels in Ekpoma, a semi urban town in South-South Nigeria. *Annals*, 3(1), 36-42.
- Akar, E., Fialho Leandro Alves Teixeira, M., & Yazicioglu, D. A. (2017). Evaluation of the advantages of usage of containers in housing production in terms of sustainability. *Advances in Social Sciences Research Journal*, 4(6), 171–178. <https://eprints.qut.edu.au/121529/>
- Anagor, A. (2019, April 22). Shipping firms turn Nigeria to dumping ground as empty containers, tankers litter Lagos roads. Business day NG. <https://businessday.ng/exclusives/article/shipping-firms-turn-nigeria-to-dumping-ground-as-empty-containers-tankers-litter-lagos-roads/>
- Anwar, S. (2020). *Life Cycle Analysis and Comparison of Different Construction Materials of Residential Buildings for Sustainable Construction Choice*. www.theseus.fi. <https://www.theseus.fi/handle/10024/339324>
- Arch Daily. (2017, November 2). *Africa Fintech Foundry Headquarters / MOE+ Art Architecture*. ArchDaily. <https://www.archdaily.com/882801/africa-fintech-foundry-headquarters-moe-plus-art-architecture>

- Azeez, T., Taiwo, D., Mogaji-Allison, B., & Bello, A. (2016). Comparative assessment of students' satisfaction with hostel accommodation in selected private universities in Ogun State, Nigeria. *European Scientific Journal, ESJ*, 12(32), 410.
- Babatunde, S. O., & Perera, S. (2017). Public-private partnership in university female students' hostel delivery: Analysis of users' satisfaction in Nigeria. *Research gate Facilities* 35(1/2):64-80 . [10.1108/F-08-2015-0056](https://doi.org/10.1108/F-08-2015-0056)
- Balogun, L. (2018). *Shipping Container as an Alternative Housing Solution: Case Study Lagos, Nigeria*. <https://www.theseus.fi/handle/10024/149465>
- Bureau For Rights Development. (2019, October 1). *Agenda 2030 - Bureau for Rights-Based Development (BRD)*. [https://www.brd-org.se/blog/agenda-2030/?gclid=Cj0KCQjwI92XBhC7ARIsAHLI9and50P3EIZ-mAjZZiDpdrm5Fe1y\\_iU3mnJNQI0AepY\\_aVI\\_9o4Fjs7IaAj8HEALw\\_wcB](https://www.brd-org.se/blog/agenda-2030/?gclid=Cj0KCQjwI92XBhC7ARIsAHLI9and50P3EIZ-mAjZZiDpdrm5Fe1y_iU3mnJNQI0AepY_aVI_9o4Fjs7IaAj8HEALw_wcB)
- Caldwell, C., & Hänninen, M. (2021). *Research and Development on Shipping Container Homes Dedicated to the Finnish Market International Business Degree Programme Final Report*. [https://www.theseus.fi/bitstream/handle/10024/496564/Caldwell\\_Conor\\_Hanninen\\_Miska.pdf?sequence=3&isAllowed=y](https://www.theseus.fi/bitstream/handle/10024/496564/Caldwell_Conor_Hanninen_Miska.pdf?sequence=3&isAllowed=y)
- Ceylan, S. (2020). Students' Approach to Recycling and Sustainability: A Design Study on Affordable Container Houses. *Advances in Intelligent Systems and Computing*, 175–181. [https://doi.org/10.1007/978-3-030-51566-9\\_24](https://doi.org/10.1007/978-3-030-51566-9_24)
- Climate Smart. (2020). *Climate Smart Homes | Our Mission*. Reall. [https://reall.net/climate-smart-homes/?gclid=Cj0KCQjwI92XBhC7ARIsAHLI9amcw2wFawjGltfYEKnrBdKN8pt\\_Pcu8-boXKG27xP40VroM3IbXgcEaAqVmEALw\\_wcB](https://reall.net/climate-smart-homes/?gclid=Cj0KCQjwI92XBhC7ARIsAHLI9amcw2wFawjGltfYEKnrBdKN8pt_Pcu8-boXKG27xP40VroM3IbXgcEaAqVmEALw_wcB)
- Container basis (2016) *Übersee container: Der Siegeszug einer Stahlkiste*. <https://www.containerbasis.de/zustaendestandard/>
- Dave, M., Watson, B., & Prasad, D. (2017). Performance and Perception in Prefab Housing: An Exploratory Industry Survey on Sustainability and Affordability. *Procedia Engineering*, 180, 676–686. <https://doi.org/10.1016/j.pro-eng.2017.04.227>



- Discombe, M. (2019, May 14). *First look inside new shipping container homes for homeless people*. WalesOnline. <https://www.walesonline.co.uk/news/local-news/shipping-container-homes-homeless-cardiff-16272511>
- Duyilemi, A. N., Tunde-Awe, B. M., & Lois, L. O. A. (2018). Cohabitation in Nigeria Tertiary Institutions: A Case Study of Adekunle Ajasin University, Akungba-Akoko, Ondo State Nigeria. *International Journal of Social Sciences & Humanities*, 3(1), 27-37. <http://ijssh.ielas.org/index.php/ijssh/article/view/23>
- Earth Design. (2023). *Clemson University ICAR | Earth Design Landscape Architecture & Environmental Design Greenville, SC*. Earth Design Landscape Architecture & Environmental Design. <http://earthdesignsc.com/project/clemson-university-icar/>
- Eteng, S., Mfon, I. E., & Okoi, B. J. (2022). Housing satisfaction among students in tertiary institutions in Calabar, Cross River State, Nigeria. *Journal of Environmental Science and Economics*, 1(3), 1-7. <https://doi.org/10.56556/jes-cae.v1i3.89>
- Frazelle, E. H. (2016). *World-class warehousing and material handling*. McGraw-Hill Education. <https://www.accessengineeringlibrary.com/content/book/9780071842822>
- Freight Right. (2023). *Shipping Container Types and Sizes|40,20 Standard, 4045*. [www.freightright.com](http://www.freightright.com). <https://www.freightright.com/guideline/container-size>
- Fritz, S., See, L., Carlson, T., Haklay, M., Oliver, J. L., Fraisl, D., Mondardini, R., Brocklehurst, M., Shanley, L. A., Schade, S., Wehn, U., Abrate, T., Anstee, J., Arnold, S., Billot, M., Campbell, J., Espey, J., Gold, M., Hager, G., & He, S. (2019). Citizen science and the United Nations Sustainable Development Goals. *Nature Sustainability*, 2(10), 922–930. <https://doi.org/10.1038/s41893-019-0390-3>
- Grigoreva, E. (2019). *Sustainable and Low-Carbon Construction of Public Buildings in Finland*. [www.theseus.fi](http://www.theseus.fi). <https://www.theseus.fi/handle/10024/161630>
- Habitat for Humanity. (2020). *Housing and the Sustainable Development Goals The transformational impact of housing*. [https://www.habitat.org/sites/default/files/documents/Solid-Ground-SDG\\_booklet-update-2021.pdf](https://www.habitat.org/sites/default/files/documents/Solid-Ground-SDG_booklet-update-2021.pdf)
- Haque, Md. O., Aman, J., & Mohammad, F. (2021). Construction sustainability of container-modular-housing in coastal regions towards the resilient community. *Built*

*Environment Project and Asset Management*. <https://doi.org/10.1108/bepam-01-2021-0011>

- Hong, Y. (2017a). A study on the condition of temporary housing following disasters: Focus on container housing. *Frontiers of Architectural Research*, 6(3), 374–383. <https://doi.org/10.1016/j.foar.2017.04.005>
- Hong, Y. (2017b). A study on the condition of temporary housing following disasters: Focus on container housing. *Frontiers of Architectural Research*, 6(3), 374–383. <https://doi.org/10.1016/j.foar.2017.04.005>
- Ibrahim, A., Musonda, I., & Ibrahim, K. (2018). *Challenges of Student Housing Provision through Public-Private Partnership*. <https://hdl.handle.net/10210/278483>
- Iidiang, M. I., Shuaibu, M. S., Dixit, S., Obong, L. B., & Bala, B. B. (2022). The Effects Of Overcrowding On Students Living In University Of Calabar Female Hostel, Cross River State, Nigeria. *Journal of Image Processing and Intelligent Remote Sensing (JIPIRS) ISSN 2815-0953*, 2(03), 31–49. <https://doi.org/10.55529/ji-pirs.23.31.49>
- Ifeoma, I. A., Ebio, A. L., & Jacob, O. N. (2021). An Evaluation Of The Problems Faced By Undergraduate Of Federal University Wukari, Taraba State Nigeria. *European Journal of Humanities and Educational Advancements*, 2(3), 20-24. <https://www.scholarzest.com>
- Islam, H., Zhang, G., Setunge, S., & Bhuiyan, M. A. (2016). Life cycle assessment of shipping container home: A sustainable construction. *Energy and Buildings*, 128, 673–685. <https://doi.org/10.1016/j.enbuild.2016.07.002>
- iTINY HOUSES. (2018, December 5). *Introducing Groningen, the continuation of Keetwonen*. Tiny Houses. <https://www.itinyhouses.com/news/introducing-groningen-the-continuation-of-keetwonen/>
- Jacob, O. N., Solomon, A. T., & Jegede, D. (2020). University Education Policies in Nigeria: Challenges Preventing the Implementation and the Ways Forward. *Journal Sinesthesia*, 10(2), 66-85.
- Lawrence, A. M., Oluwatoyin, A. O., & Charles, A. F. (2018). The influence of socio-economic characteristics on satisfaction in selected universities students' hostels in Southwestern, Nigeria. *American Journal of Computer Architecture*, 5(1), 1-19.

- Livinspaces (2018, March 1). *Modern home in abuja built in 8 weeks*. <https://www.livinspaces.net/projects/architecture/modern-home-abuja-built-just-8-weeks-using-shipping-containers/>
- Resource Rows. (2017). *Resource Rows*. TU Delft. <https://www.tudelft.nl/en/architecture-and-the-built-environment/circular-design-atlas/resource-rows>
- Nduka, D. O., Oyeyemi, K. D., Olofinnade, O. M., Ede, A. N., & Worgwu, C. (2021). Relationship between indoor environmental quality and sick building syndrome: a case study of selected student's hostels in Southwestern Nigeria. *Cogent Social Sciences*, 7(1), 1980280.
- Nicholas, I., OBI, J. S. C., IBEM, E. O., NWALUSI, D. M., & OKEKE, O. F. (2021). Noise pollution in urban residential environments: Evidence from students' hostels in Awka, Nigeria. *Journal of Settlements and Spatial Planning*, 12(1), 51-62. <https://doi.org/10.24193/JSSP.2021.1.05>
- Ogungbe, M. A., Olukolajo, M. A., & Binuyo, O. P. (2018). An investment analysis of private student hostel in Nigeria tertiary institutions: a case of FUTA campus. *International journal of investment management and financial innovations*, 4(1), 1-8. <http://www.aascit.org/journal/ijimfi>
- Ojoko, E., Omuya Abubakar, H., Ojoko, O., & Ikpe, E. (2016). Sustainable Housing Development In Nigeria: Prospects And Challenges. *Journal of Multidisciplinary Engineering Science and Technology (JMEST)*, 3, 2458–9403. <https://center4affordablehousing.org/wp-content/uploads/2020/06/JMESTN42351596.pdf>
- Olanrewaju, S., Garba, G., & Onigbogi, O (2022). A Review on Students' Housing in Nigerian Universities. *African Journal Online (AJOL)*. <https://www.ajol.info/index.php/laujoces/article/view/240201>
- Osazuwa, O. N., Iroham, C. O., & Oluwunmi, A. O. (2021). Factors Affecting The Effectiveness Of Maintenance In Postgraduate Hostels In Highly Ranked Nigerian Universities. *IOP Conference Series: Earth and Environmental Science*, 655(1), 012002. <https://doi.org/10.1088/1755-1315/655/1/012002>
- Philip, A., Ileanwa, A. C., & El-Hussain, A. M. (2018). Post-occupancy evaluation of students hostel facilities in Federal Universities in North Central, Nigeria. *Architecture Research*, 8(4), 123-128.
- Resource Rows. (2017). *Resource Rows*. TU Delft. <https://www.tudelft.nl/en/architecture-and-the-built-environment/circular-design-atlas/resource-rows>

- Strauch W (2018) Securing the product in the container. [http://www.containerhandbuch.de/chb\\_e/stra/index.html](http://www.containerhandbuch.de/chb_e/stra/index.html).
- Taleb, H., Elsebaei, M., & El-Attar, M. (2019). Enhancing the sustainability of shipping container homes in a hot arid region: A case study of Aswan in Egypt. *Architectural Engineering and Design Management*, 15(6), 459–474. <https://doi.org/10.1080/17452007.2019.1628002>
- The Global Challenge for Government Transparency. (2020). *Supporting the Sustainable Development Goals*. African Promise. [https://www.africanpromise.org.uk/charity-work/supporting-the-sustainable-development-goals/?gclid=Cj0KCQjwI92XBhC7ARIsAHLI9amBWtJ1g8rZeV1fYVkvxgzl0AvWET-z11DiRpFX6Hc3KKmFOyFHaoaAm-3EALw\\_wcB](https://www.africanpromise.org.uk/charity-work/supporting-the-sustainable-development-goals/?gclid=Cj0KCQjwI92XBhC7ARIsAHLI9amBWtJ1g8rZeV1fYVkvxgzl0AvWET-z11DiRpFX6Hc3KKmFOyFHaoaAm-3EALw_wcB)
- United Kingdom Architecture News. (2014). *A Shipping Container Hotel You Can Play Jenga With*. World Architecture Community. <https://worldarchitecture.org/architecture-news/pmvgm/a-shipping-container-hotel-you-can-play-jenga-with.html>
- United Nations Conference on Trade and Development (UNCTAD)–Secretariat (2019) Review of Maritime Transport. United Nations Publication, Geneva, Switzerland.
- United Nations. (2019). Implementation of The Sustainable Development Goals *National Review*. [https://sustainabledevelopment.un.org/content/documents/23576ISRAEL\\_13191\\_SDGISRAEL.pdf](https://sustainabledevelopment.un.org/content/documents/23576ISRAEL_13191_SDGISRAEL.pdf)
- Usman, B (2020). Evaluation on Students Hostel Accommodation in Tertiary Institutions: A Case Study of Some Selected Institutions in Borno State-Nigeria. *National Innovation and Research Academia*. <http://www.arcnjournals.org/images/NIRA-USD-6-4-1.pdf>