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Sustainable Green Building Awareness: A Case Study of Kano Integrated with a Representative Comparison of Saudi Arabian Green Construction

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Abstract: The aim of this research is to assess sustainable green building awareness in Kano State, in a case study of the Gwale local government area. This research makes use of both primary and secondary data to address these offered solutions. Descriptive and quantitative analysis using the BREAM and LEAD evaluation standards was used to analyze the case study and 251 questionnaires were distributed. To ensure a fair trial of each of the 251 building samples, they were chosen at random from various parts of the Gwale Yan-Alawa ward. A case study of a selected green building was chosen and analyzed. The logical comparison with Saudi Arabia was made. It is concluded that the Nigerian government at the national level should put more effort into encouraging green building construction through public awareness programs and incentives and subsidizing the green system.

Keywords: green construction; green building; sustainability; green-building rating system; Kano State; Saudi Arabia

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1. Introduction

The global population is increasing, along with the demand for existing and new constructions that is driving significantly the sprawling of cities throughout the world. As a result, private and public buildings worldwide are becoming more and more dependent on basic services and supplies. Green building is defined as a building concept which is ecologically beneficial in terms of construction processes, low maintenance cost, comfortability and saving energy/cost. Nevertheless, culture has not been incorporated among the pillars of sustainable development around the world; when incorporated, it will become the fourth pillar of sustainable development and will be included among environmental, social, and economic aspects [1]. The availability of fresh water is a great challenge in Kano State with 62% of the urban and rural districts in Nigeria [2]. Water is an important part of green building, because it provides the building with basic amenities necessary for human life within the building. Therefore, natural sources of water were considered to be part of green building to reduce the cost of bills and buying water from the commercial water vendors. The "Energy-Saving and Land-Saving Residential Building" mandated by the central government in 2004 gave rise to the idea of green construction in China. To be more precise, a green construction should be "Four Saving and One Benign", or energy, land, water, and material efficient. It should also reduce pollution. That is described in the Evaluation Standard for Green Building (hence referred to as ESGB), a national standard adopted by China in 2006 [3]. Over 40% of the total energy produced worldwide, according to SCBI and UNEP, is consumed by buildings, which produce one-third of the carbon emissions produced globally, with a predicted 34% increase for the long future (20 years). But these structures pollute the environment, through factors such as noise pollution, air pollution, and land degradation [4,5]. Providing autonomous structures that depend on renewable energy sources is one of the most effective methods to alleviate such issues and reduce reliance on the public energy source and other amenities supplies [6]. This will provide buildings with independent energy and sanitary services, and lower the cost of house maintenance for the building occupants. Additionally, it saves time and resources while paying taxes, contributing to the sustainability of humankind worldwide [7]. The provision of sunshades, according to relevant scholars, can contribute to sustainable building; installing renewable energy sources (such as wind, solar, hydro, and organic) for the delivery of electricity; the installation of boreholes and the storage of collected rainfall for the supply of drinkable water; window installation on two or more walls of each room for cross-ventilation and lighting; methane gas generated by organic materials (rotting food scraps as well as animals and human wastes) for cooking, insulating the walls and roof to stop the temperature exchange from inside and outside, etc. [8]. To create a favorable building environment, concern for the season must be taken into account. Housing needs were addressed in the millennium goals, and using locally produced products and upgrading them can increase cost savings over purchasing imported building components [9,10]. Additionally, it reduces time while constructing, making it simple for people to create homes. Environmental sustainability is the core goal of green architecture, and the architect's plans might help to lessen our current environmental problems [11]. The green building grading system is crucial for creating green standards and a more sensible approach to environmental challenges, as well as a focus on creating a sustainable constructed environment. The use of materials with a higher energy density raises the energy required for construction, which increases the amount of dangerous gas emissions released into the environment resulting from the manufacturing of building materials and the construction, rehabilitation, and repair of buildings not safe for our environment [12].

In Nigeria, there are few sustainable constructions in existence, resulting from a lack of green building (GB) knowledge, as well as an unfavorable economic climate and inadequate Nigerian government regulations and laws. Therefore, it is difficult to persuade potential customers to design or invest in a GB in Nigeria [13]. Inadequate building supplies and standards were also present due to the depreciation of the Nigerian naira currency, which also resulted in disastrous building projects. These issues encourage the usage of low-quality materials throughout construction procedures [12]. This behavior runs counter to sustainable goals, and will make the nation more vulnerable to catastrophes. Nigeria's administration has unveiled a National Housing Policy (NHP, 1991), devised to address the problems of housing in the nation. To implement this, laws were created regarding the National Housing Scheme (NHS). But in order for the Nation Housing Policies to succeed in their housing-related objectives, they must offer the right housing-related solutions [14]. High rates of urbanization in the areas surrounding urban centers, high prices for construction materials, unemployment, and poverty were listed as contributing factors to Nigeria's housing crisis. Because of this, Nigerian NHP primarily favours the wealthy, not the poor, due to high purchasing prices of houses in the nation [15].

Nigeria's electricity supply challenges are of the utmost importance, and are met through the Kano State's electric power holding company (i.e., KEDCO, which is another name for the Kano Electric Distribution Company); this company does not provide enough electricity to the citizens, and this brings about a serious issue with the provision of electricity across Kano State [16,17]. Additionally, local wells or boreholes are the primary water supplies for Kano's residential houses, and 60.7% of the city's residents obtain drinking water on demand from the water sellers in the area [2]. For a very long time the municipal water supply company (alternatively referred to as WRECA, the Water Resources and Engineering Construction Agency) has been ineffective, and does not pump enough water to meet the needs of the people. Kerosene and firewood, which both release a lot of harmful gas pollutants into the atmosphere, were the only available cheap heat energy sources in Kano State. When Nigerian architects create a self-sufficient structure that can rely on the environmentally friendly use of renewable sources of energy, these problems can be reduced by utilizing the idea of green and sustainable building mechanisms, such as solar, wind, hydro, and organic energy.

Nigeria's population is growing quickly, which has resulted in increasing demand for basic building supplies like electricity, clean water, and other necessities. Poor governance and corruption, lax implementation of development control laws, problems with building codes and legislation, and an unregulated birth rate have all contributed. To attain reduced demand is essential for achieving sustainable goals. In Nigeria, several locations have severe storm-water runoff issues that can result in widespread floods. In Nigeria, the majority of structures require heating and cooling during the hot, dry, rainy, and cold seasons [1]. Together with additional energy consumption around the nation, this demand raises energy use to a total of 60% [18,19]. When consumers and architects are discouraged from using green construction methods, barriers like a lack of desire for doing so from the commercial and public sectors exacerbate the issue. The weather in Kano State shifts over long period a variety of climate factors, with temperature at its heart. It is obvious that the surface temperature rose significantly between 1986 and 2016. From 1986 to 2016 a range of 11.4–27.9 °C and 17.4–56.2 °C respectively, were recorded as the lowest and highest temperature [20]. This demonstrates the significant climate change differential of about 5 °C in Kano City, which was mostly brought about due to the rapid growth rate, building construction and manufacturing industries. The research gap found in this investigation was the lack of improved practices and awareness of green in Nigeria when compared to the Saudi Arabian green building system. However, the barriers and drivers of green building are yet to be known by the government and the general public, and this research attempts to fill in these gaps and provide room for future research.

The major aim of this research is to assess the sustainable green building awareness in Kano city and to identify the perception barriers and driving factors of green residential building development in the city.

The following are the study's objectives:

1. To extensively examine the existence of green buildings in Kano State;
2. To determine the significance of green building to the case study and its associated problems;
3. To assess the satisfactory perception of users in the study area regarding green building;
4. To provide practical methods for raising public awareness showing the need for green construction.

2. Research Methodology

This research makes use of both primary and secondary data, which is essential since both instruments are required in collecting sufficient facts in this research to display and investigate the data. On-site primary data collection was carried out at the specific locations of each building. A GPS device will be used to collect the necessary coordinates, as well as other information including photos and measurements using the appropriate tools. On the other hand, online sources, the housing ministry, mortgage banks, and other pertinent governmental or non-governmental sources, as well as several other secondary sources, will be used in this study. Additionally, a different kind of computer program and unprocessed data with new computer applications will be developed, which will then be analyzed in the study and presented. Examples of various computer programs include Microsoft Excel and Word, Matlab, SPSS, and Google Earth Pro. Table 1 summarizes the objectives of this research, the data type required to achieve each objective, and the method of data collection and analysis.

Table 1. Method of Data Collection.

Objective	Data Type	Data Collection Method	Data Presentation
To extensively examine the existence of green buildings in Kano State.	Primary data.	Questionnaire GPS	Descriptive
To determine the significance of green building to the case study and its associated problems.	Primary information. Further information utilizing a web map.	Personal observations; Questionnaires; Interviews and Google-maps.	Descriptive
Assessing the satisfactory perception of users in the study area regarding green building.	Both primary and secondary.	Perceptions of the users Interviews with locals Field research Questionnaires.	Descriptive
To provide practical methods for raising public awareness showing the need for green construction.	Primary data.	Questionnaire Personal interview and observation	Descriptive

2.1. The Research Method Flowchart

The flowchart as shown in Figure 1 below begins with data input from both primary and secondary sources, examples of which are shown in the figure. Primary data involve the questionnaire administration of 251 respondents; personal observations were used to collect data of both the case study and site presented in this research, which were backed up with photos of the study in Section 3.1 in this article. Meanwhile, the secondary data were also used in this research to collect information from other sources such as GPS coordinates from Google Maps, the literature Review, interviews, the Ministry of Housing and Kano State Urban Development Authority in Nigeria. Interviews using both telephone conversations and physical meetings with the government officials of both the government and the state staff of the Ministry of Housing and Kano State Urban Development Authority were carried out in an effort to obtain secondary data related to this study.

The input was used and processed using a mixed method (i.e., a qualitative and quantitative method), which means the involvement of computer applications to perform statistical analysis. Each variable mentioned in this research was examined carefully and sent to the decision stage to decide whether it had solar energy incorporated and if it was sustainably green. If so, would pass to the next stage; if not, it would loop back and be discarded. The output in this flowchart displays only sustainable green features which are presented using descriptive analysis, and thus the process is completed.

2.2. Data Sources

For this study, it is necessary to use both primary and secondary data sources. Government agencies and online sources served as the paper's secondary data sources. Field-based personal observations, interviews, questionnaires and measurements on-site were used, which were primarily sourced in this research. This document includes numerous examples of tools that were used collected from both primary and secondary data. The main tool used here is a questionnaire distributed to the respondents, which is accompanied by a verbal interview, field observations, agencies from both the public and private sectors, the global positioning systems (GPS), phone conversations, and video/picture recording equipment. Table 2 below shows the relevant data types used and their sources in this research.

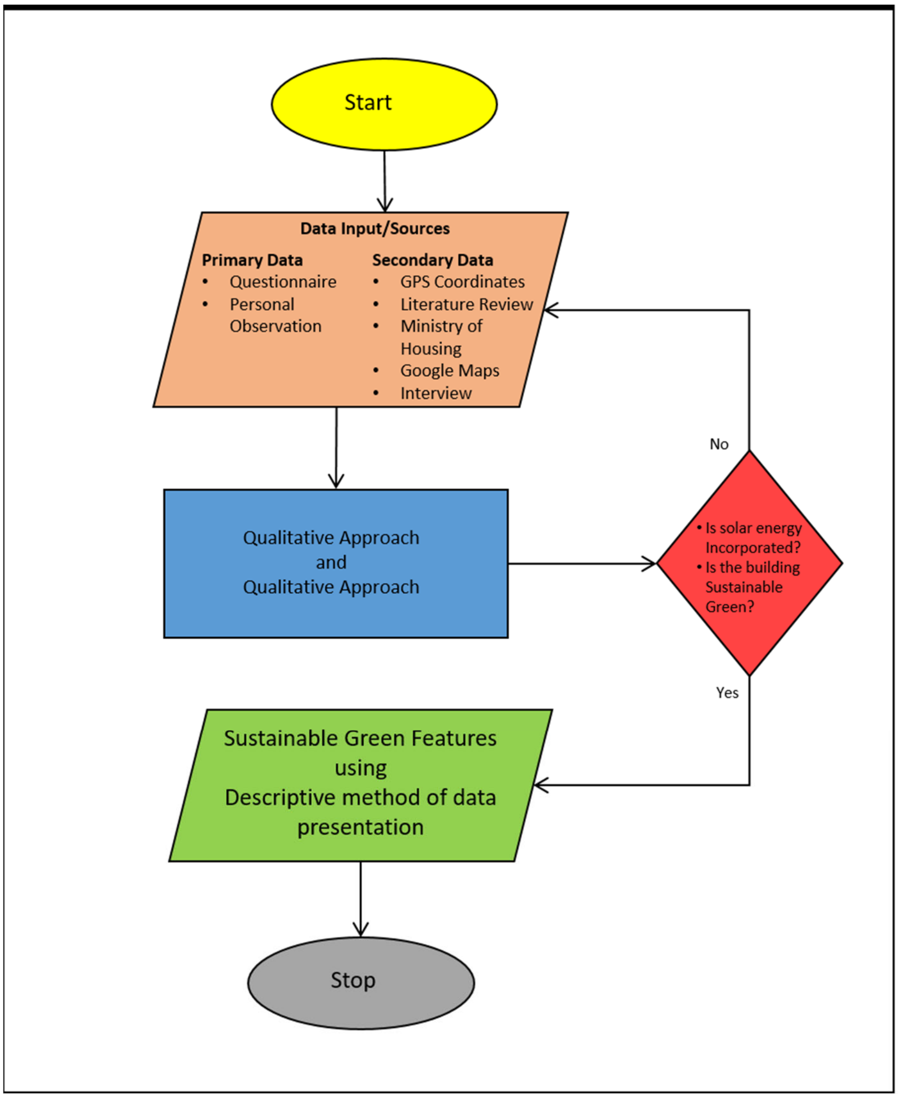


Figure 1. The flow chart explaining the method followed in this research.

Table 2. Types of data used along with their source.

S/N	Data	Sources
1.	Counting buildings	Secondary (Nigerian National Housing Commission); primary (counting the building physically on site)
2.	Map and places	Secondary (Google Map and Google Earth software, 5.1 Google Earth Pro)
3.	Measurements	Primary (field-work using measuring tape)
4.	Sustainability-related evaluation criteria of green buildings	Both primary and secondary (physical field parameters, BREAM and LEED)

2.3. Sampling Procedures I

This process began with a literature review to try to come up with the main knowledge areas for this study, such as aims and goals. The researcher conducted the full investigation and accurately categorized the several types of publications that would apply to this research. The questionnaire was carried out online using Google Forms. However, as the research developed, citations were gathered through Mendeley Desktop as the citation/reference software.

a. Unit of measurement

For the purposes of this study, the study area will be measured in term of housing building units. When assessing the building, standard green building assessment will be employed in this study, taking into account the LEED and BREAM rating schemes. The measurement of metres, mass, and volumes will all continue to be carried out using their respective International System of Units, e.g., temperature ("°C"), length ("m"), weight ("kg"), and so on, because it will be helpful to evaluate the sustainable infrastructure in the research region. The standards and convenience of the sustainable building are rated, but other factors such as quality, contentment, and capital are also taken into account.

b. Sample frame/population

The target sample for this study focuses on energy-efficient and green buildings in the vicinity of Kano City. These samples were randomly chosen from residences within the area of study, which are analyzed by the use of questionnaires. One house was randomly selected, and it was then studied and regarded as the case-study, implementing the LEED and BREEAM grading systems, which gives the investigator a special perspective for achieving an accurate result.

c. Sample size

Currently, no information is available on the overall number of buildings in Kano State, as stated by the Ministry of Housing, Kano City, making it impossible to undertake this study without estimations of the total buildings in Kano State generated. This study uses households with approximately five (5) people, a number approved by the Nigerian government, and the data are made up of the overall inhabitants of Kano State as counted in the 2006 census [21]. During the administration of President Jonathan Goodluck in the year 2012, the Nigerian Federal Government approved this household size, due to an absence of sufficient information from Kano State's housing regulatory organization. The overall population (11,058,300) will be used to acquire the total number of buildings [22]. This is calculated by dividing the total population of Kano State by the number of the approved household size.

Present in equation as:

$$Kano\ State\ buildings = \frac{\text{OPK}}{\text{ANH}} \tag{1}$$

where,

OPK refers to overall population of Kano State
ANH means approved number of a household in Nigeria.

Mathematically,

$$\frac{11,058,300.00}{5.00} = 2,211,660.00\ Kano\ Household$$

The households were regarded as buildings in Kano, and can also be classified into 44 LGs to acquire the total number of residents in Gwale LG in the city, expressed as:

$$Gwale\ Local\ Government\ Buildings = \frac{\text{KB}}{\text{TLK}} \tag{2}$$

where

Kano State buildings were regarded as KB
Total local government buildings of Kano State was regarded as TLK

Mathematically,

$$\frac{2,211,660.00}{44.00} = 50,265.00\ buildings\ in\ Gwale\ Local\ Government$$

In the local government area of Gwale, there are 10 wards: Kwanar Diso, Galadanchi, Sani Mai-Nagge, Dandago, Kabuga, Dorayi, Mandawari, Gyaranya, Gwale Yan-Alawa and Goron Dutse [23]. The study took place in the Gwale Yan-Alawa ward, which has the following characteristics:

$$The\ total\ number\ of\ houses\ in\ Gwale\ Yan-Alawa\ qtrs = \frac{\mathrm{THG}}{\mathrm{TNWG}} \tag{3}$$

where

THG = Total number of house in Gwale local government,
TNWG = Total number of wards in Gwale local government.

Mathematically,

$$\frac{50,265.00}{10.00} = 5026.50\ Houses\ in\ Gwale\ Yan-Alawa\ ward$$

The accompanying formula was used to calculate the required number of respondents for this study's sample size (overall samples). Following is a mathematical analysis of the randomly selected 5% samples out of the whole number of samples:

$$Overall\ Samples = (OBG) \times \left(\frac{5}{100}\right) \tag{4}$$

where

OBG means overall number of buildings in Gwale LG.

Mathematically,

$$Overall\ Samples = (5026.50) \times \left(\frac{5}{100}\right) = 251.325\ Houses\ (\mathrm{Respondents})$$

As a result, a total of 251 homes (respondents) in the Gwale Yan-Alawa ward will receive a questionnaire, one per home and selected at random.

d. Sampling Techniques

A number of factors were taken into account when choosing the sample method that would produce the best results for this study. Implementing random sampling techniques to provide questionnaires in the study area is the first step. A total of 251 building samples were chosen at random from a pool of 5026.5 potential candidates. The majority of the study's aims and objectives can be achieved successfully in this manner.

2.4. Sampling Procedure II

Later, using a stratified random sampling method, the 5% of the samples from sustainable buildings was calculated to be 251 building samples. To ensure a fair trial of each sample, these samples would be chosen at random from various parts of the Gwale Yan-Alawa ward. Randomly chosen, one case study will be carefully examined based on surrounding elements including physical observations, floor plans, and other variables of green building.

3. Results and Discussion

3.1. Study Area

The most populous city of Nigeria's 36 states is Kano State, which is also known as the center of commerce, due to the enormous commercial activity in the city. Kano State has Sudan savannah vegetation, including indications of Guinea savannah in the state's southern region [24].The state typically has Sudan savannah in the north and east. Yakubu Gowon, a former head of state in the military, created Kano, which is situated in Nigeria's northwest, on 27 May 1967. Kano State shares borders with Bauchi State to the southeast and Kaduna State to the southwest. The states of Katsina and Jigawa are to the north and west, respectively. Table 3 give more details about Kano State; these include 470 people per km^2 of population density, a vegetation of Sudan Savannah, the coordinates (11°30′00″ N; 08°30′00″ E), April-to-October rainfall duration, a minimum of 10 °C and maximum 41 °C of temperature, and a 20,131 km^2 total land coverage.

Table 3. Details about the research field [22,25–27].

S/N	Kano	Figures
1	Densities	470 People/km^2
2	Coordinate	11°30′00″ N, 08°30′00″ E
6	Overall land cover	20,131 km^2 (7773 mi^2)
4	Rainfall durations	April–October
3	Vegetation	Sudan Savannah
5	Temperature difference	10 °C and 41 °C

Figure 2 below shows a map of Kano in Nigeria and in Africa. The map shows a population of 1,305,000,000 for the entire continent of Africa. Kano State was chosen for this study because it has 12,554,819 residents, which is huge percentage of the 195,458,568 persons that live in the entire Nigerian nation. The map is scaled 1:10 (meaning 1 cm is equivalent to 10 m) and is orientated to the north. In order to highlight the specific delineation of the city chosen for this study, political boundaries are indicated on maps of Africa and Nigeria. Nigeria's population is 195,458,568 persons according to the 2006 census and Kano's projected population is 12,554,819 for 2019; Kano represents 6% of Nigeria's projected population [22]. According to [28], Nigeria's current population reached 221,240,967 in 2023.

3.2. The Building Selected as the Case Study

Figure 3 shows a satellite view of the specific study area chosen for this research, i.e., see pegs A–D. The building is situated in the Gwale Yan-Alawa qtrs. The building chosen was located on Baffale Street, with a water pond at the back and separated by one wall from the adjacent neighbouring buildings.

The overall number of buildings in Kano state and Gwale LG. are shown in this Table (Table 4). The number of green building structures in Gwale was obtained from the questionnaire distributed. The 234 respondents stated that the building they live in has some features of a green building, and therefore their building was considered as GB. The green buildings in Kano state and Gwale LGA statistics were extrapolated from the Nigerian population statistics of 2006, in relation to the numbers of allowed household sizes by the Federal Republic of Nigeria. This was utilized to determine the exact number of sustainable structures available, while the questionnaire was used to count the 234 green buildings in total. To establish a more precise number of green buildings in Kano state, additional practical study may be needed.

Table 4. The Case Study.

	Number of Buildings	Amount
1.	The whole buildings in Kano State	2,211,660.00
2.	The overall buildings in the Gwale LG.	50,265.00
3.	Overall green residents in Gwale ward	234.00

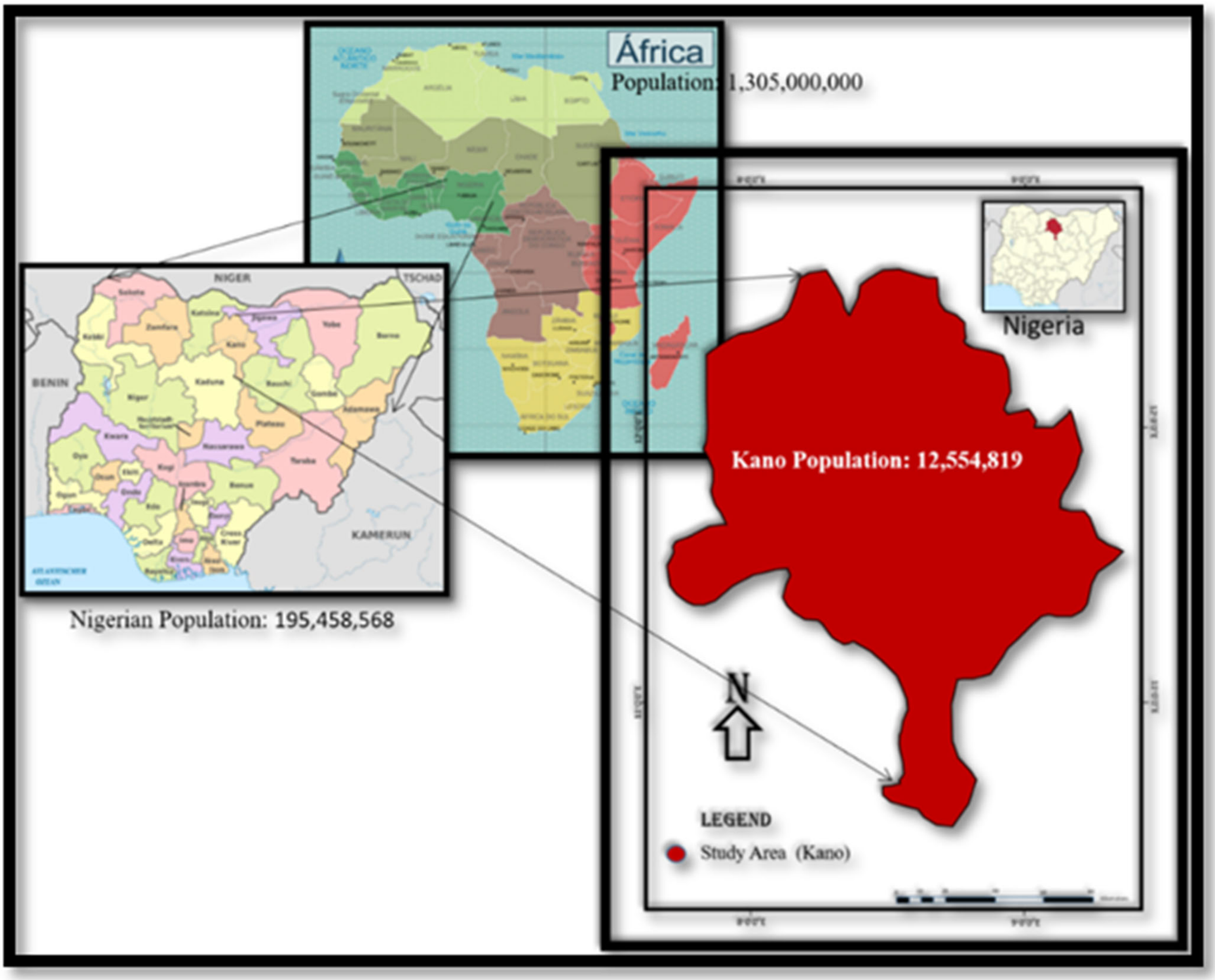


Figure 2. Study Area and Population [22].

Figure 3. The Case Study: Satellite View (scale of 1 cm:500 m depth) [29].

3.3. The Selected Building for the Case Study

For the case study, the green building is chosen, based on a set of methodical criteria, including access to the facility with permission to remain private. Both the building's BREAM/LEED accreditation and its location inside the specified study area require that it should have more than 50% of its total area covered by green features. Despite the paucity of writings on green architecture in Kano state, the Gwale local government region has a number of architectural features. The following table lists the monitoring locations for the four pegs (See below, in Figure 4 and Table 5) in the Gwale ward of the Gwale LG. at Yan-Alawa quarters, Nigeria.

Figure 4. The Rectangle Pegs (A–D) on a satellite map [29].

Table 5. Table of Coordinates of the Green Building [29].

	Peg	Coordinates	
		N	E
1.	D	11°59′11.61″ N	8°30′22.34″ E
2.	C	11°59′11.74″ N	8°30′22.85″ E
3.	B	11°59′12.45″ N	8°30′22.55″ E
4.	A	11°59′12.31″ N	8°30′22.24″ E

In Table 5, coordinates are shown in the rectangular area of Figure 4 and the map is aligned to north. A map with a 60-foot-per-cm, or 18.29 m-per-centimetre scale was used. The building's eastern side is bordered by small twin ponds, and it faces a narrow road. Despite the building's access to public water and electrical sources, neither of these are constantly supplied and have become unstable in the area for several years. Water supply especially has not been seen at all for many years in this area. The house is partially separated from a nearby house by a single wall. In Figure 4, on the other side of the building, the property is bordered by a strip of land that is enclosed by a temporary wall. In Nigeria, both types of winds blow from the north to the south and vice versa: the northerly winds are typically cool, dry, and dusty, while the southerly winds bring lots of humidity and rain. The building includes inside cross-ventilation and is constructed to receive winds in both the two wind directions.

The overhead water tanks on the rooftop of this building supply water to the structure using gravitational force, and they are accessible using the metal ladder on the building's left side (see Figure 5A,B below). An underground tank was present to store both the rainwater and for the public water supply, while both public and solar electricity supplies are used to power the electric boreholes to fill up the overhead tanks. There about four water sources in this building; these are the public, rain harvest, well and borehole water sources. Similarly, the courtyard provides security, air circulation within the rooms, a parking lot and a playground, and plants are provided in this building. This region of the property will receive a northeast wind, throughout the dry or hot season.

(A) (B) (C)

Figure 5. (**A**) Showing the window placements and the red bricks used for solar shading in the GB at Gwale LGA, Kano. (**B**) The solar panel in the environmentally friendly building. (**C**) Displaying the front of a home in Gwale Yan-Alawa, Kano.

The solar panels are on the roof; they were installed and recharge these 24 batteries (Figure 5B). The structure is powered by the solar panel, and energy-saving devices like electric bulbs and fans are placed to save energy consumption in this building. This solar setup is enough to provide power for the structure for up to around 24 h in duration.

Windows were designed in a cross-ventilation manner throughout the building. The leaves from the trees depicted in Figure 6 were used to reduce the impact of the sun and wind penetrating into certain parts of the building. The southwest air is likely to blow across this area of the building during the rainy season.

(A) (B) (C)

Figure 6. (**A**) Displaying the hallway, windows, solar shed bricks, inverter air conditioning, and adequate daytime illumination. (**B**) Lighting and cross ventilation in the rooms. (**C**) Using a thick curtain for light and visibility control.

Air conditioner compressors use an electrical system to change the electric current speed. This mechanism, which regulates electrical voltage, frequency, and current, is put into a variety of domestic electronic gadgets and is regarded as an inverter system. The inverter air conditioning system controls the compressor's speed and tracks the flow rate of the coolant (gas) so that the device consumes the least amount of heat and electricity possible (as shown in Figure 6A).

As evidence that this structure has inside space, access to natural sunlight, privacy, and safety, are shown in Figure 6B,C; however, the windows are covered with a net to keep insects away.

The characteristics of this green structure are as follows:

- Solar energy, which is used to power the building;
- The use of energy-efficient appliances in the home;
- The use of gravity in the water supply throughout the building;

- The presence of adequate natural illumination and cross ventilation within the interiors;
- Oxygen–Carbon exchange using the vegetation available in the building;
- Sun-shading brick placement to reduce sunlight in the morning and late afternoon;
- The design of an underground tank to collect rainwater;
- Collection and treatment of wastewater from pit latrines and kitchen waste;
- Minimal waste production, through land reclamation by solid-waste sorting, reusing and filling part of the pond at the back of the building with waste.

The irregular public electricity power cuts in Kano's urban core, together with the numerous issues related to building and neighbourhood sustainability were alleviated in this GB. The building was able to provide the basic building necessities to itself, in such a way as to make it a green building.

4. Data Presentation and Analysis

4.1. Data Collection

Questionnaires was used extensively in this chapter to collect data for the study. A descriptive technique was used to present and analyze the 251 questionnaire replies. Only the building's kind of evaporative cooling system question received 24 responses; all other questions had the same number of responses given to each (out of 251 responses). Cultural- and religion-related limitations prevented physical or direct observations inside the homes, ss the majority of residents refused to allow the researcher to observe inside their personal residence. This the reason behind using the questionnaire to retrieve the information from the respondents themselves.

4.2. Personal Data

i. Respondents' age range

Table 6 and the pie chart in Figure 7a show the respondents' age groups (251 responses), of which 5–25-year-old respondents make up 13.00%, 26–35-year-old respondents make up 34.00%, and 36–45-year-olds made up 31.00% of the responses found in the study area. Therefore, the majority were between 26 and 35 years old, because the average lifespan of Nigerians was below 55.75 years (56 years approximately) of age around the year 2022. A 0.57% increase was recorded from 2022 [30].

ii. Respondents' gender

In Table 6 and the Figure 7b pie chart, males made up 80.00% of the respondents, while women made up 20.00%. As a result, men were the majority of the respondents met during the questionnaire administration of this research. This is because it is culturally and religiously taboo for most women to live alone in Hausa land (Northern Nigeria), with very few exceptions.

iii. Respondents' educational level

Table 6 and the Figure 7c pie chart indicate the respondents' educational background, with secondary school graduates making up 25.00% of the total. Tertiary education, master's degrees (M.Sc. and M.Tech.) and PhD. holders represent 46.00%, 24.00%, and 5.00% of the population, respectively. The majority of the senior and middle-aged group in the field of research were educated and own at most a higher-studies diploma, as seen by the replies that rank degree/diploma/NCE as the highest.

iv. Respondents' field of study

Architects made up 6.00% of the participants in this study area, civil engineers made up 10.00%, and other occupations that were non-building-related made up 29.00% (refer to Table 6 and the Figure 7d pie chart). This demonstrates that the majority of respondents in the research area who studied other related fields made up 55.00%, who were employed in non-building-related sectors. This is because most of the respondents were either government employees or business owners and Kano state is well-known for merchandise and commercial activities as being the major occupations of the citizens living in the city.

v. Nationality

With 98.00% Nigerian citizenship, the respondents were almost entirely Nigerian, although 2.00% of the household responses collected for this study came from people who also held dual citizenship with another country (refer to Table 6 and the Figure 7e pie chart).

vi. Marital status

A total of 64.00% of respondents were married, 17.00% were divorced, 14.00% were single, and 5.00% were separated. Due to the fact that most respondents were families, it was clear from these data that married respondents made up the majority (64.00%) of the sample (refer to Table 6 and the Figure 7f pie chart).

Table 6. Data collected from the questionnaire.

Personal Data	
Respondents' age range	Frequency Percentage
5 to 25	13.00
26 to 35	34.00
36 to 45	31.00
over 45	22.00
Total	100
Respondents' gender	Frequency Percentage
Male	20.00
Female	8.00
Total	100
Respondents' educational level	Frequency Percentage
Secondary	25.00
Tertiary	46.00
Master's	24.00
PhD	5.00
Total	100
Respondents' field of study	Frequency Percentage
Architect	6.00
Engineer	10.00
Non-building-related field	29.00
Other building-related fields	55.00
Total	100
Nationality	Frequency Percentage
Nigerian	98.00
Dual Citizenship	2.00
Total	100
Marital status	Frequency Percentage
Single	14.00
Married	64.00
Divorced	17.00
Separated	5.00
Total	100
Socioeconomic Information	
Respondents' occupation	Frequency percentage
Employed	55.00
Unemployed	8.00
Self-Employed	37.00
Total	100
Respondents' ownership status of residence	Frequency percentage
Owner	26.00
Tenant	59.00
Free Occupancy	15.00
Total	100

Table 6. *Cont.*

Socioeconomic Information	
Respondents' household size	Frequency percentage
1 to 2	9.00
3 to 4	17.00
5 to 6	14.00
Above 6	60.00
Total	100
Respondents' monthly income range (NGN)	Frequency percentage
Less than 33,000	52.00
33,000–66,000	33.00
66,000–99,000	9.00
Above 99,000	6.00
Total	100
Respondents' monthly income range (NGN)	Frequency percentage
Less than 20,000	68.00
20,000–29,999	9.00
30,000–40,000	18.00
Above 40,000	5.00
Total	100
Respondents' water and energy expenditures per month (NGN)	Frequency percentage
Less than 9000	86.00
9000–14,000	7.00
14,000–20,000	5.00
Above 20,000	2.00
Total	100
Respondents' monthly costs for upkeep and house renovation	Frequency percentage
Less than 20,000	86.00
20,000–30,000	7.00
30,000–40,000	5.00
Above 40,000	2.00
Total	100
Green Building	
Green-building awareness	Frequency percentage
Yes	97.00
No	3.00
Total	100
Green-building feature availability per dwelling	Frequency percentage
Yes	93.00
No	7.00
Total	100
The buildings' number of rooms	Frequency Percentage
1 to 3	12.00
4 to 6	63.00
7 to 9	20.00
10 and above	5.00
Total	100
Window count in a room	Frequency Percentage
0	1.00
1	30.00
2	52.00
3 and above	17.00
Total	100
The overall number of windows in the whole building	Frequency Percentage
0	1.00
1 to 10	89.00
10 to 20	7.00
20 and above	3.00
Total	100

Table 6. *Cont.*

Green Building	
The number of lamps in the structures	Frequency Percentage
0	1.00
1 to 5	36.00
6 to 10	58.00
More than 10	5.00
Total	100
How many electric fans there are in the building	Frequency Percentage
0	4.00
1 to 2	17.00
3 to 4	41.00
More than 4	38.00
Total	100
The total number of television sets in the house	Frequency Percentage
0	15.00
1	74.00
2	6.00
More than 2	5.00
Total	100
The number of AC units in the house	Frequency Percentage
0	90.00
1	3.00
2	3.00
More than 2	4.00
Total	100
The buildings' energy-efficient appliances	Frequency
0	98.40
1	74.10
2	9.600
More than 2	75.70
Daytime indoor natural-light perception	Frequency Percentage
High intensity	12.00
Moderate intensity	64.00
Fair intensity	22.00
No intensity	2.00
Total	100
Buildings' courtyard availability	Frequency Percentage
Yes	98.00
No	2.00
Total	100
Indoor thermal comfort	Frequency Percentage
Very comfortable	12.00
Comfortable	64.00
Fairly comfortable	22.00
Not comfortable	2.00
Total	100
Availability of natural evaporative cooling system in the building	Frequency Percentage
Yes	10.00
No	90.00
Total	100
The kinds of evaporative cooling mechanism available in the houses	Frequency Percentage
Swimming pool	25.00
Natural pond	42.00
Water fountain	33.00
Waterfall	0
Total	100
The construction material used in the walls	Frequency Percentage
Clay bricks	20.00
Wood or dried herbs	2.00
Laterite	3.00
Cement brick	75.00
Total	100

Table 6. *Cont.*

Green Building	
The number of restrooms in the houses	Frequency Percentage
0	1.00
1	87.00
2	6.00
3 and above	6.00
Total	100
The number of kitchens available in the buildings	Frequency Percentage
0	1.00
1	92.00
2	3.00
3 and above	4.00
Total	100
The refuse management in the houses	Frequency
Central collection system	62.00
Incinerating	5.00
Landfill/pond-fill	67.30
Recycle and reuse	33.90
The electrical power sources available in the houses	Frequency
Renewable	14.30
KEDCO	99.60
Fossil fuels	20.70
None	0.40
The buildings' energy sources for cooking	Frequency
Renewable	10.80
Fossil fuels	98.00
KEDCO	2.00
None	0.00
Total	100
The buildings' water supply systems	Frequency
WRECA	1.00
Borehole and well	59.00
Rain harvest	5.60
Commercial vendors	61.00
Response from the insulation in building walls	Frequency Percentage
Yes	12.00
No	88.00
Total	100
Buildings' roof insulation systems	Frequency Percentage
Yes	97.00
No	3.00
Total	100
Perceptions of green buildings as a way to reduce home maintenance costs	Frequency Percentage
Yes	97.00
No	3.00
Total	100
The users' general satisfaction and perceptions of green-building-system satisfaction	Frequency Percentage
High satisfaction	6.00
Moderate satisfaction	75.00
Fair satisfaction	17.00
No satisfaction	2.00
Total	100

4.3. Socioeconomic Information

a. Respondents' occupation

About 55.00% of the participants in our study region were employed; the percentage of unemployed was 8.00%, and those who were self-employed individuals made up 37.00% of the workforce. This indicates that most of the respondents worked for specific governmental groups or were employed by companies, or by small-to-medium-sized businesses. Most of the people who were self-employed were business proprietors and owners of SMEs (refer to Table 6 and the Figure 7a pie chart).

b. Respondents' ownership status of residence

Tenants provided the majority of answers to the questionnaire (60.00% of all replies in the study area), followed by free occupants (14.00%) and respondents who owned a house (26.00%). This shows that the majority of the respondents were tenants (refer to Table 6 and the Figure 7b pie chart).

c. Respondents' household size

For the categories of household sizes in a residence, 9.00% of all responses reported fell into the 1–2 category, followed by 17.00% for 3–4 people and 14.00% for 5–6 people per household. A total of 60.00% of respondents said that there were more than 6 people per dwelling unit, which helps to explain why Kano is very highly populated within Nigeria (refer to Table 6 and the Figure 7c pie chart).

d. Respondents' monthly income range (NGN)

The respondents' monthly range of earnings are recorded in Naira (NGN). According to Table 6 and the Figure 7d pie chart, 33.00% of respondents fall into the income range of NGN 33,000–66,000, while NGN 66,001–99,000 had 9.00% of the responses, and the above-NGN-99,000 class had the fewest, at 6.00% (refer to Table 6 and the Figure 7d pie chart). However, 52.00% of the respondents here earn less than NGN 33,000 per year because the majority of respondents here who work for the government are within the minimum wage of the NGN 30,000 monthly stipend. This reveals the extent of poverty and hardship the respondents are facing in the selected town.

e. Respondents' general expenditures per month (NGN)

Monthly costs of house maintenance in the research area on average are presented above, in Table 6. The respondents who received the questionnaire spend less than NGN 20,000 on house maintenance, and they made up 68.00% of the total responses, followed by the NGN-20,000–20,000 respondents with 9.00%; the NGN-30,000.00–40,000.00 class of respondents had 18.00% of the responses, and the above-NGN-40,000.00 class of respondents had 5.00% of the responses. This is clear, given that the income rates in Table 6 and the Figure 7e pie chart show that the majority of the respondents spend below NGN 33,000 on house maintenance and that the expenditures likewise fall within the respondents' overall earnings.

f. Respondents' water and energy expenditure per month (NGN)

The spending of the residents per month for energy as well as water, focuses on finding out how much the local populace spend on heating, electricity and water utility bills and determining if they take energy-saving steps for both electric and cooking energy sources. The less-than-NGN-9000 group respondents provided 86.00% of the responses, followed by the NGN-9000–14,000 group, at 7.00%; then the NGN-14,000–20,000 group had 5.00%, and the above-NGN-20,000.00 group was at 2.00% (refer to Table 6 and the Figure 7f pie chart). The greatest responses here are for less than NGN 9000, which includes costs for electricity, heating, water, and any other relevant household energy requirements. This is due to the fact that most homes utilize an energy-efficient system and possess at least one "well" for the purpose of obtaining water for home usage. The people of the community buy water from the 'Dan-ga-ruwa' or 'Me-ruwa' which both mean water vendors, usually because the water they offer is potable, considering the fact that the well water in the houses around this study area is hard water.

g. Respondents' monthly costs for upkeep and house renovation

The existing monthly costs for home renovations as displayed in Table 6 and the Figure 7g pie chart show the data based on monthly house maintenance and improvement costs. The less-than-NGN-20,000 section makes up 87.00%, followed by NGN-20,000–30,000 with 7.00%, NGN-30,000–40,000 with 4.00%, and over-NGN-40,000 with 2.00%. This shows that the majority of the respondents use below NGN 20,000.00 N in the monthly maintenance and refurbishment costs of their buildings.

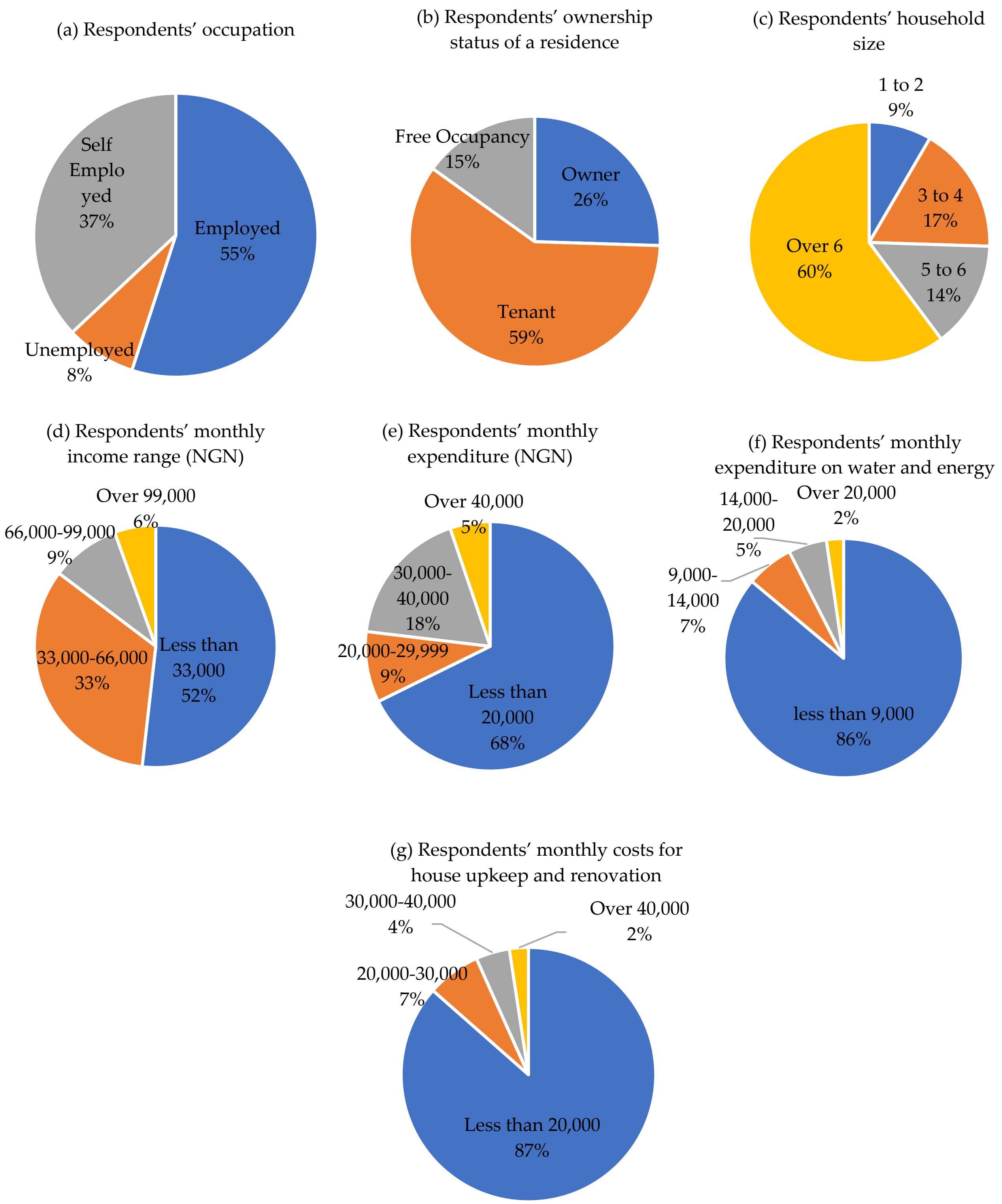


Figure 7. Socioeconomic data.

4.4. Green Building

i. Respondents' green building (GB) awareness

These responses in the aforementioned table display the degree of public knowledge of the locals in the study area. About 97.00% of all comments came from locals, indicating that they are aware of the green building system. On the other hand, those who were unaware of green buildings made up just 3.00% of the population. However, this query provided an answer to the study's primary goal. Table 6 and the Figure 8i pie chart presents the records of the green building existence data.

ii. Respondents' green building feature availability per dwelling

Using the questionnaire, the researcher sought to determine whether green building features are available in each residential unit. There were 7.00% of "no" responses, compared to an average of 93.00% "yes" responses. The response to the adoption of green construction features was impressive throughout the research region, indicating that Kano State has long been a proponent of green building. Table 6 and the Figure 8ii pie chart present the availability of green building features.

iii. The number of rooms in the respondents' buildings'

The data for the number of rooms in the building are presented in Table 6 and the Figure 8iii pie chart. One-to-three rooms account for 12.00% of the responses, while four to six rooms made up 63.00%; 20.00% of households had seven-to-nine rooms, and 5.00% had ten or more. This result suggests that between four and six rooms make up the majority of households. This indicates that there is a surprisingly large number of occupants in nearby buildings, where the study is being conducted, which could lead to a significant demand for water and energy to meet their needs.

iv. Respondents' window count in a room

The windows in the rooms were counted and are presented in Table 6 and the Figure 8iv pie chart, in an effort to determine the cross ventilation of the rooms. A total of 1.00% of respondents reported having no windows at all, compared to 30.00% of those with just one window; 52.00% of the total respondents had two windows in their rooms, while 17.00% had three or more. Most of the responders employ, on average, two windows per room in this case study (Table 6 and the Figure 8iv pie chart). This mean that there are two windows in two different walls in their rooms, which provide them with cross ventilation inside the confined space. Having multiple windows in one wall or direction is counted as one window in this research, because they may not provide efficient cross ventilation.

v. The overall number of windows in the whole building

Table 6 and the Figure 8v pie chart show how many windows there are in the entire structure. The windows in the rooms within the individual buildings are counted and documented in this question according to class range, which this question is related to the previous one (i.e., section 'iv', number of windows per room). A total of 1.00% of dwellings had no windows, 89.00% had about ten windows, 7.00% had ten-to-twenty windows, and 3.00% had thirty or more windows. The average dwelling has ten windows altogether.

vi. The number of lamps in the structures

This inquiry aims to determine how energy-efficient the structures are by determining the total number of electric lamps the individual structure has. Responses indicating no lamps make up 1.00%; those indicating one-to-five lamps make up 36.00%; those indicating six-to-ten lamps make up 58.00%; and those indicating more than ten lamps make up 5.00%. As a result, it may be deduced that most of the homes in the research region had between six and ten lamps lighting the inside (refer to Table 6 and the Figure 8vi pie chart).

vii. How many electric fans there are in the building?

In Nigeria, the majority of homes utilize their rooms with either ceiling or freestanding fans throughout the year, except during the cold season. Buildings without any fans correspond to 4.00% of respondents, meaning they do not use electric fans in any way; 17.00% mentioned one-to-two fans, 41.00% mentioned three-to-four fans, and 38.00% mentioned four or more electric fans. The majority of homes have three-to-four electric fans in this study area (refer to Table 6 and the Figure 8vii pie chart).

viii. The total number of television sets in the house

The total number of televisions in the building is shown in Table 6 and the Figure 8viii pie chart, in which 15.000% of homes give no (0) responses, 74.00% of homes have one television, and individuals who have two or even more televisions make up 6% and 5.00%, correspondingly. The majority of homes reportedly only have one television, according to this survey.

ix. The number of ACs in the house

The responses for the number of air conditioners in the building are shown in Table 6 and the Figure 8ix pie chart above; 90% of replies reveal that the majority of homes in the study region have not installed air conditioning in their houses. Residents with one, two, or more air conditioners present make up 3.00%, 3.00%, and 4.00% of the responses, respectively. Consequently, many occupants are unable to pay for the electricity required to run air conditioning (electric consumption), let alone buy it.

x. The buildings' energy-efficient appliances

The household's energy-efficient devices are also recorded in Table 6 and the Figure 8x bar chart. In this case, the respondent has the option of selecting more than one answer from a list of options. The majority of the respondents—98.40%—use energy-efficient light bulbs in their homes, followed by televisions (74.10%), energy-efficient air conditioning (9.60%), and energy-efficient electric fans (75.70%). This indicates that most homes are moving in the direction of green building practices to reduce the cost of their electricity bills.

xi. Daytime indoor natural-light perception

The amount of ambient light in the rooms was measured during the day by obtaining the opinions of the residents regarding the houses. A total of 12.00% say it is very bright, while bright has a 64.00% frequency response, followed by fairly bright with 22.00% and not bright at all with 2.00%. This demonstrates that the majority of the indoor lighting and visibility in this study area achieves the bright option, which shows that the indoor visibility is between the hours of 7 and 6 pm, without an artificial light source or a fire (refer to Table 6 and the Figure 8xi pie chart).

xii. Buildings' courtyard availability

The buildings' courtyard accessibility shows that about 98.00% of the buildings in this area are the courtyard-building type, whereas only 2.00% are not, as shown in Table 6 and the Figure 8xii pie chart. This shows that the vast majority of the residents have a courtyard in their buildings.

xiii. Indoor thermal comfort.

The responses to the respondents' perception of indoor thermal comfort show the respondent's perception of the thermal comfort of their interior spaces in Table 6 and the Figure 8xiii pie chart. A total of 12.00% of the respondent said they are very comfortable, 64.00% said they are just comfortable, and only 2.00% of people thought their accommodation was not comfortable, while 22.00% found it to be at least fairly comfortable. This shows that the majority of the building's interiors are made cozy by using ceiling fans or air conditioning to reduce the warmth of the buildings, or by allowing cross ventilation between the indoor and outdoor. Also, the process of making sure that the extreme heat from the sun is avoided in the walls is helped by planting some trees along the sun directions.

xiv. Availability of natural evaporative cooling system in the buildings

A total of 90.00% of the dwellings in the study region did not have evaporative cooling systems. Those structures using evaporative cooling systems received 10.00% of all replies. This indicates that the vast majority of the structures in the immediate vicinity lack evaporative cooling systems. Table 6 and the Figure 8xiv pie chart show the existence of a building's natural evaporation cooling system.

xv. The kinds of natural evaporative cooling system available in the houses

This question is linked to the previous one (see Figure 8xiv), which analyses the relevant kinds of evaporative cooling systems found in the building, and includes 10.40% of respondents (24 responses from the 251 overall respondents) who claim to have a natural cooling mechanism based on the data presented in section 'xiv' above. Table 6 and the Figure 8xv pie chart show that 25.00% say a swimming pool is available, 33.00% choose a water fountain, and 42.00% a natural pond. The two (2) natural ponds that are present in the research region influence most of the 24 respondents to select it over all other options.

xvi. The construction material used in the walls

The construction material used in the walls is presented in Table 6 and the Figure 8xvi pie chart. The houses are composed of clay bricks (20.00%), wood/dried herbs (2.00%), and laterite (3.00%), respectively, which are used as building materials for their walls. However, the majority of responses (75.00%) support the use of cement brick.

xvii. The number of restrooms in the houses

How many restrooms are there in the house? The number of toilets a house has may influence how much water is needed for maintenance and use. Only 1.00% of homes in the study area said they had no toilet at all. While just one toilet was present in 87.00% of the responses, two, three or more toilets were available for 6.00% and 6.00% of the responses, respectively. The bulk of the structures in the Gwale ward were discovered to have only one (1) toilet per dwelling, as shown in Table 6 and the Figure 8xvii pie chart.

xviii. The number of kitchens available in the buildings

Table 6 and the Figure 8xviii pie chart show the number of kitchens in the houses, which is assumed to affect how much energy is used in cooking and water consumption. Looking at the fact the polygamous marriages attract multiple wives, with each having her own separate kitchen, this is common in the study area selected for this research. Only 1.00% of the respondents said that there was no kitchen in their homes, which is the lowest percentage selected. The respondents with just one kitchen scored the highest, of 92.00%, which signifies a shared kitchen in a polygamous family; 3.00% and 4.00% respectively, are found to be households with two and three or more kitchens. This suggests that the majority of respondents have at least one kitchen in each of their homes. Some respondents selected more than one kitchens as a result of a firewood kitchen available in addition to a gas or kerosene stove in both the roofed and unroofed area within their houses.

xix. The refuse management system used in the houses

This inquiry aims to ascertain how the accumulated waste is disposed within the houses in this neighbourhood. Additionally, because there are several choices available, responders may choose more than one answer. The response to the approved central garbage collection system shows that 62.20% of respondents use it. Due to the fact that most household garbage is moist and non-flammable, just 5.00% of the responses say they are incinerating their waste. A total of 67.30% responses say it goes to filling ponds or land, while 33.90% say it is going to recycle and reuse. This demonstrates that the majority of locals either dump their waste on surrounding land or ponds (67.30% responses) or dump their refuse at the general point of collection (6.20% responses). However, some homes recycle and reuse their waste (33.90% responses), while others even sell their recyclables to neighbourhood scavengers. Reuse and recycling are strongly promoted because they are sustainable. The waste collection and disposal system responses are shown in Table 6 and the Figure 8xix bar chart.

xx. The electrical power sources available in the houses

The buildings' electric energy sources are shown in Table 6 and the Figure 8xx bar chart, which present the fact that the respondents' choice for renewable energy in the area of electricity was 14.30% (using biodiesel, wind turbines, or solar energy). KEDCO makes up 99.60% of the electric sources of the respondents, which is provided by the public electric distribution company. Combustion engines use fossil fuels to produce 20.70% of the respondents' electricity, while 0.4% of the respondents have chosen not to use any. This demonstrates that the majority of respondents primarily utilize KEDCO as a source of electricity, despite its instability within the country.

xxi. The buildings' energy sources for cooking

The buildings' energy source data for cooking are presented in Table 6 and the Figure 8xxi pie chart above; in light of the global issues with cooking energy and the trending sustainability concerns, this question is important. Although there are several answers available, this question allows multiple choices to be selected at once. Fossil fuels, with 98% of the responses, received the highest marks of the sample analyzed, followed by the public electric source from Kano Electric Distribution Company (KEDCO) with 2% and renewable cooking energy with 10.80% of the responses. No respondents indicated the 'none' option, with this receiving 0%. This shows that the majority of residents do not consider KEDCO's public power supply to be a better option for cooking, because it is unreliable and expensive. Additionally, the majority of people were ignorant about methane gas flares and solar cookers. Methane gas is produced from food waste or any other type of organic material, and Jatropha jelly (a source of biodiesel) [31]. Kerosene, firewood, and normal cooking gas have so far been the most accessible and cost-effective supplies they have found.

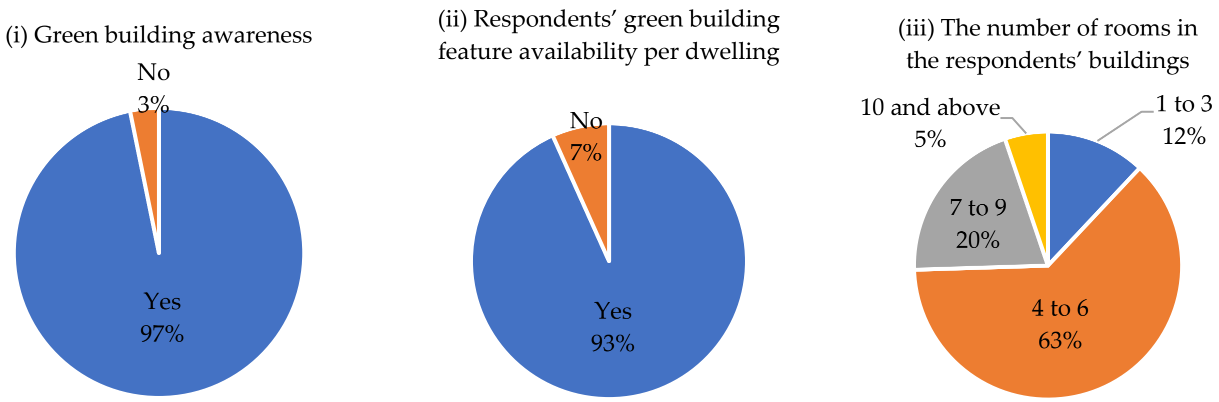
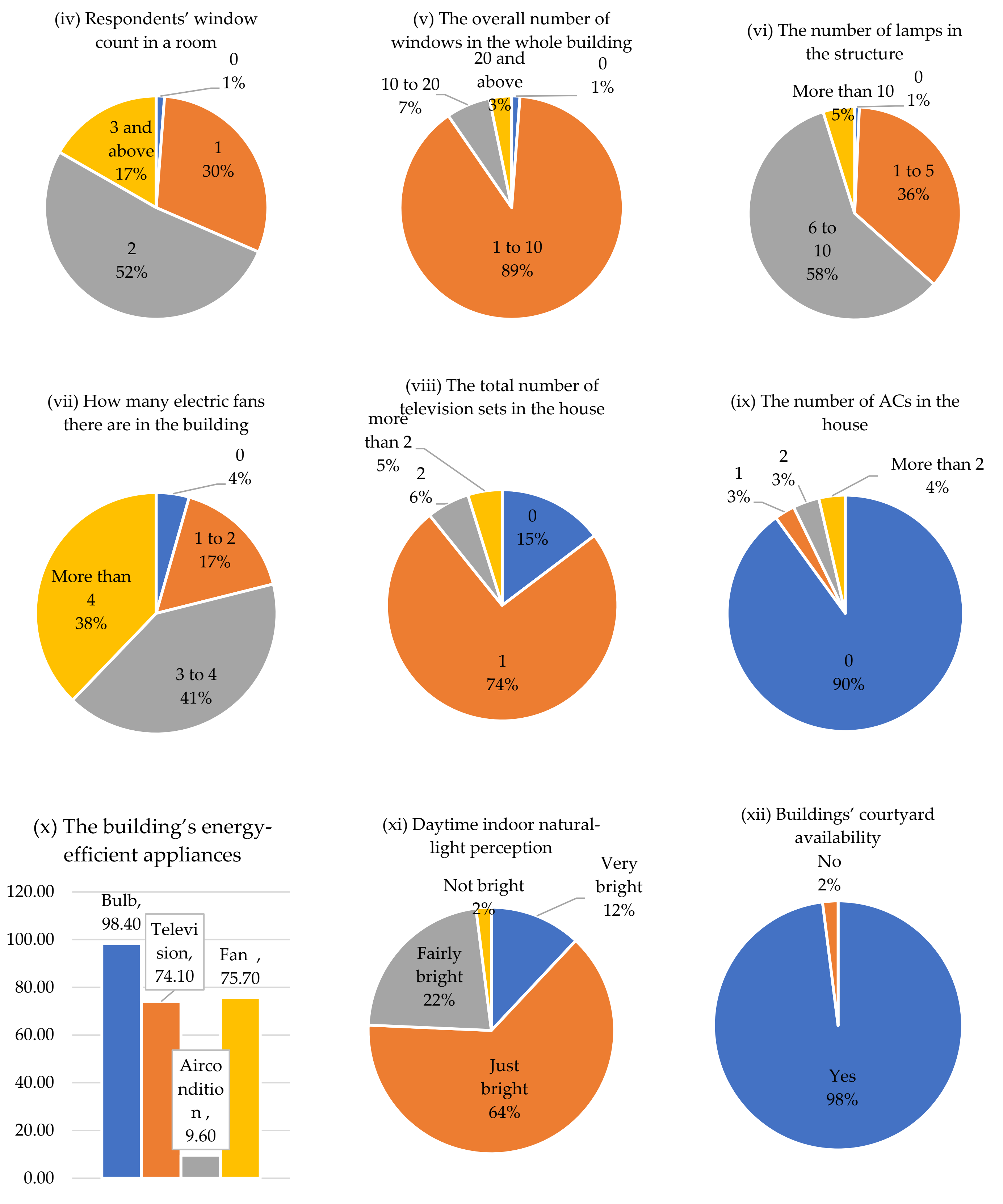


Figure 8. *Cont.*



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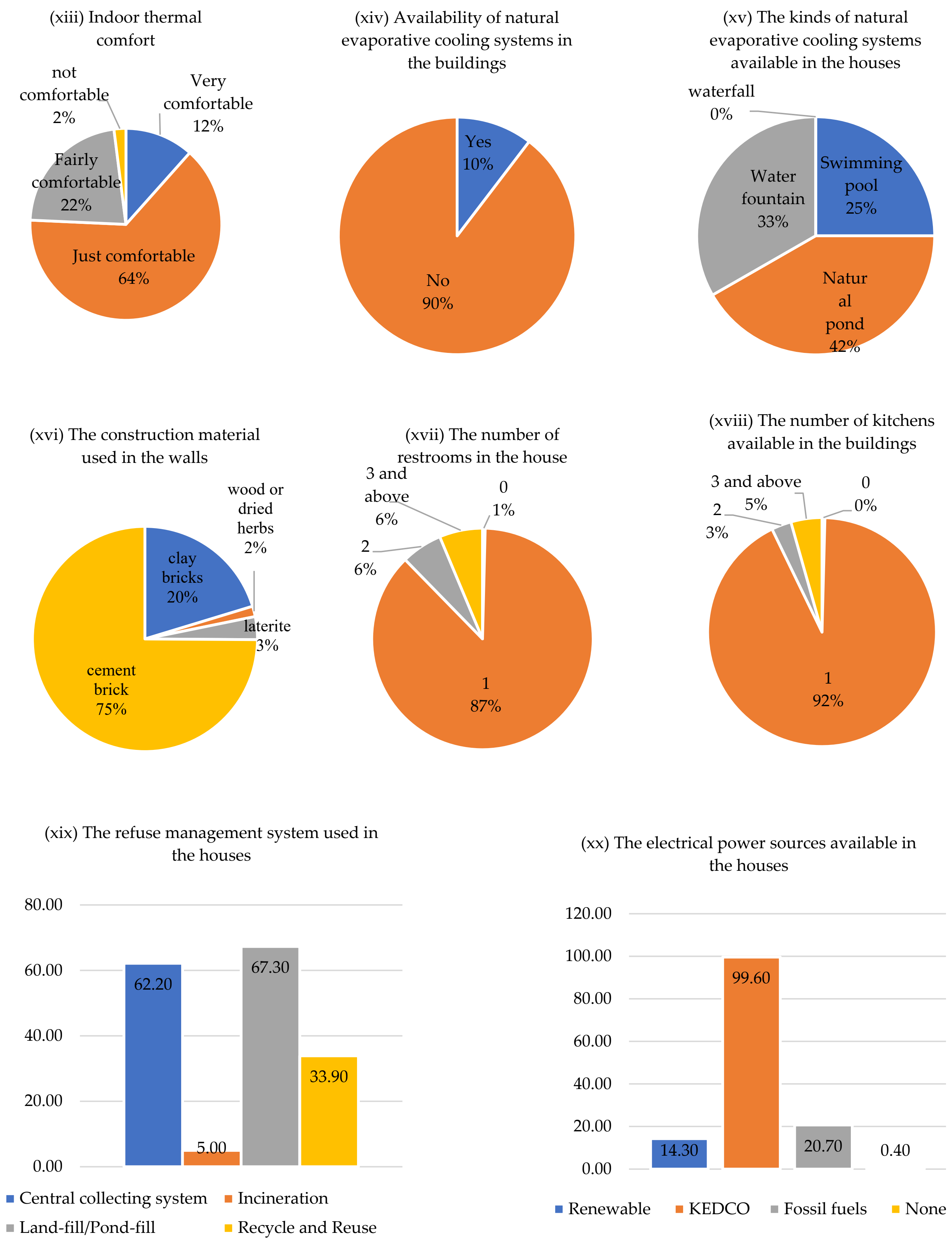

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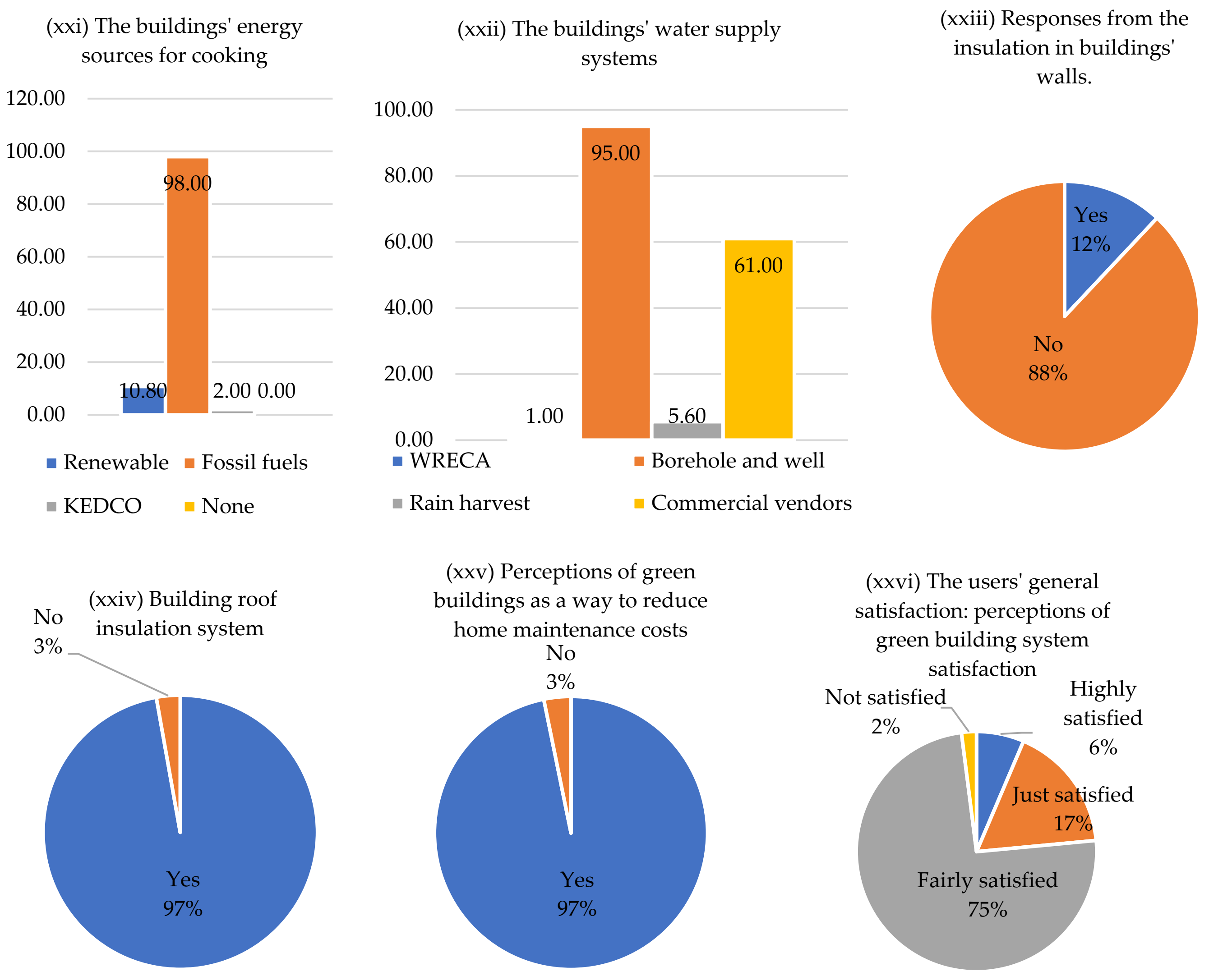

Figure 8. Green building data.

xxii. The buildings' water supply systems

The building's water supply systems, as shown in Table 6 and the Figure 8xxii bar chart, demonstrate the responses gathered from a variety of research participants. A total of 95.00% of the respondents use boreholes and wells, and 1.00% use the Water Resources Engineering and Construction Agency (WRECA). Rain harvest has a 5.60% record, and commercial vendor utilization is 61.00%. That the majority of Kano City's public water supply issues from WRECA is nothing new. Since hard water from wells and boreholes is typically utilized for bathing and household sanitation, soft or potable water is usually bought from commercial vendors, and is used for drinking and cooking. This results in a high demand for a locally constructed well or mechanical borehole, because it is the only cheap and reliable source of water when compared to other sources.

xxiii. Responses from the insulation in building walls

The building's walls have access to insulation systems presented in Table 6, and the Figure 8xxiii pie chart shows that 12.00% of respondents report having insulation in their walls, compared to 88.00% of respondents who claim their building has no wall insulation. Wall insulation is therefore not widely seen in most of the buildings around the study area.

xxiv. Buildings' roof insulation system

The roof insulation present in the houses in Table 6 and the Figure 8xxiv pie chart shows that similar results can be seen, where 97.00 of the respondents claim to have insulation on their roofs, as opposed to 3.00% who do not have roof insulation installed. This is due to the fact that the majority of responders insulate the heat from the roofing sheets used to cover the building's roof, by using the ceiling.

xxv. Perceptions of green buildings as a way to reduce home maintenance costs

Does using green building techniques help you save money on utility bills and maintenance? Table 6 and the Figure 8xxv pie chart show that almost all respondents (approximately 97.00%) feel that green building systems help them save money on utility bills and upkeep, which makes the response to this question exceptional. On the other hand, a total of 3.00% of respondents believe it is not assisting them in any way.

xxvi. The users' general satisfaction: perceptions of green building (GB) system satisfaction

How satisfied are you with your GB structure overall (i.e., in terms of comfort, cost, house upkeep, and sustainability issues, etc.)? In Table 6 and the Figure 8xxvi pie chart, this questionnaire addresses one of the study's objectives. The moderate satisfaction option has 75.00% responses, fair satisfaction has 17.00%, high satisfaction has 6.00%, and 2.00% are not at all satisfied. This finding indicates that the majority of those that used green building practices in the research area were happy with their homes' overall green building system available within their houses.

5. Discussion

Building and building enables people to fulfil their own social requirements for housing, their own economic needs for investment, and their own corporate objectives. However, full fulfilment of these goals typically comes at a significant cost, namely, long-term harm to our ecosystem. This has resulted in a rising awareness of the need to change or possibly enhance our traditional method of growth into a much more responsible approach that can meet our requirements for progress without harming the environment in which we live. Since then, a number of forward-thinking international gatherings have raised awareness of environmental and sustainability issues, including the Rio Earth Summit in 1992, the Maastricht Treaty in 1992, the Kyoto Conference on Global Warming in 1997, the Johannesburg Earth Summit in 2002, and the Washington Earth Observation Summit in 2003 [32]. Many nations have taken good steps and made plans to apply and absorb this ideology inside their businesses as a result of the ideas and methods inspired by these global events. Sustainability is a subdivision of this ideology. The construction sector may actively and positively contribute to environmental protection through the idea of sustainable building [33]. Energy is used extensively during the construction and upkeep of buildings. They have a very high level of environmental effect, as a result. It has been determined that the construction industry, which is a component of infrastructures, is responsible for around 25–40% of energy use, 30–40% of material resource consumption, 30–40% of waste generation, and 30–40% of greenhouse gas emissions worldwide. Additionally, estimates show that about 30% of recently constructed or renovated buildings have sick building syndrome, exposing their occupants to unhealthy environmental conditions [34]. As a result, the green building concept is being promoted as the main method of ensuring the sustainable development of infrastructure. Going green means being more aware of our responsibilities and our part in reducing the negative impacts on the environment.

The advent of the new development theory known as sustainable development in the Brundtland Report of 1987 provided the possibility for change. Cultural sustainability also involves traditional building; this is because every culture has certain building patterns using local materials. Some scholars regard culture as social sustainability, while many scholars feel that culture is a sustainable pillar on its own. In this research many traditional buildings possess some green building features, which are shown in the Results section (Table 6). Green building is a concept that has been attracting substantial interest from scholars recently, due to the growing concerns for the environment and the need to reduce carbon emissions. The term "green building" describes the planning, development, and ongoing use of structures that respect the environment and conserve resources. This covers the use of environmentally friendly materials, energy-saving technology, and waste and pollution reduction. Dr John Robinson, a professor at the University of British Columbia, is one of the foremost experts in the subject of green construction. Dr Robinson has carried out a great deal of research into sustainable urban development and has written and published a many books and papers on the topic. According to Dr Robinson, green construction is an essential part of sustainable urban development and may lessen the environmental effect of cities [35]. Dr William McDonough is another well-known expert on the subject of green construction. He is also an architect and designer who has won awards for his work in sustainable design. The book *Cradle to Cradle: Remaking the Way We Make Things*, which promotes a closed-loop system of production and consumption that reduces waste and pollution, was co-authored by Dr McDonough. In his work, Dr McDonough emphasizes the importance of design [36]. Several architects and scientists around the world have discussed green building and global warming. Some of them had findings in common with this research and some had contrary findings. This study finds that although there is awareness regarding green buildings in Kano, more efforts are required to enlighten the public about the sustainable benefits of it. These results are similar to the findings of [37], who also stated that there is green building awareness in the city, but the efforts on how to implement it are not enough on the part of both the clients and stakeholders. This results in the majority of property users, owners and investors injecting fewer funds into the green building market, and consequently this results in the rapid climate change caused by buildings and construction industries or activities around Kano. Ref. [38] discovered that home owners and shareholders both use fewer sustainability metrics and do not view sustainability prospects as being crucial in the real estate markets. Similarly, ref. [8] stated that there is increasing demand for green building in Kano State, which also adds value to it; this shows that green building awareness is gradually gaining attention in the city. A study was carried out in and around Melbourne's Central Business Area, which is Australia's Victoria, and it shows that promoting green construction practices across Melbourne requires collaboration among users, stakeholders, clients, and researchers. As a result, the greenhouse gas emissions from Kano State will be highly diminished through GB. Similarly, ref. [39] stated that the national economy, laws, and market dictate the construction sector, and were only a few examples of the several types of aspects that affected individuals' preferences for green construction; the market sector is influenced by psychological decision making and processes. Due to lack of client demand and the low number of inhabitants in Kano state, the green building market is seeing low financial return when compared to the state's existing demographic situation. Similar to this, Nigeria's national laws and government policies governing the growth of green construction are also ineffective, luring people who choose conventional building over green building. Here, some significant guiding principles and measures should be presented in order to take green building construction development in Kano state into consideration. Both private (stakeholder and client) and public organizations can implement interventions, particularly with respect to economic factors of the society, to improve the development and transformation of green buildings. Additionally, it is feasible to grow the market for green buildings in Kano state and throughout Nigeria by using both internal and external forces.

Energy efficiency is among the main concerns globally, which in green building can be easily achieved using renewable energy sources and the installation of energy saving appliances. Renewable sources of energy are very expensive to install in Nigeria, though, and most of the green building users choose to use solar energy more than any other renewable source. This is because a solar energy system is easy to install and has generates less noise, but it is still considered as costly. Results from this research show that the general public cannot afford the solar energy system in Kano state, which forces the public to use the KEDCO public electricity source; however, some green building users mix both

KEDCO and a solar system. However, large numbers of residents in Kano state use fossil fuel electric generators in powering their homes, especially at night, and in their businesses during the daytime.

Urban space restrictions can make it challenging to use renewable energy sources such as solar energy systems. However, this restriction can be removed by using the building facades as energy generators [40]. Buildings utilize up to 40% of the world's energy, and they are also responsible for 33% of the planet's greenhouse gas (GHG) production. Buildings require both thermal and electrical energy for a variety of functions, including lighting, heating spaces, and hot water delivery. The requirement for energy is growing daily due to the increase in global population [41]. To supply this need, fossil fuels have been extensively utilized worldwide in the generation of thermal and electrical energy. The availability of fossil fuels is constrained, and using them has harmful environmental repercussions. Regarding this, there has been a significant global trend toward the use of sustainable energy systems in a variety of applications [42]. By using renewable energy sources, GHG emissions might be reduced. Many countries offer incentives for the use of renewable energy, as a result [43]. Solar energy and other renewable energy sources may be used to provide electrical and thermal energy. Utilizing solar irradiance is one of the most popular, practical, and cost-effective ways to produce electricity when compared to other renewable resources. It should be mentioned that the potential for solar energy use across the world is substantial [44]. Rethinking the design of buildings and utilizing renewable energy sources are crucial in the construction industry because they may reduce energy use and increase thermal comfort. Since solar energy is cheap, abundant, and clean, it makes sense to replace conventional energy with it. As a result, solar energy is crucial to buildings' power supplies.

Sources of water for both domestic use and portable drinking water remains a huge problem in Nigeria. Kano, having the highest population in Nigeria, has a critical public water supply problem. In this research, the major sources of water are the well and the borehole. The public water supply was not seen for many years in this area, and the problems behind this water supply problem were stated by [45] who listed insufficient funds, power supply, lack of autonomy, and poor maintenance as being behind the problems of water supply in the city. These are the reasons behind purchasing potable water, which is used for both cooking and drinking, from the commercial vendors in this study area. The author also stated that 550 million liters of water was the water demand in 2014, while in 2021 the demand decreased to 415 million liters for the daily supply, as stated by [46]. He later suggests that alternative provision for water treatment plants will help provide enough water for the city.

The generation of waste, both solid and liquid, is improperly disposed and untreated. This is because Kano city does not have a single solid- or liquid-treatment plant in all the state. The Refuse Management and Sanitation Board, REMASAB, is a government agency responsible for the collection and disposing of the waste from the Kano city metropolis, but its management practices were not successful, as stated by [47]. This is because REMASAB dispose of the collected waste into existing ponds and open lands surrounding the city. However, the waste generated by residential houses accounted for 62.5% around Kano city [47]. In Nigeria, current initiatives for climate change adaptation and mitigation have focused on limiting greenhouse gas emissions, but they have minimal influence because awareness is lacking at the community level. Sustainability adaptation and mitigation methods would be highly effective if they were easily comprehended and allowed individuals to take part in economic activity to earn a living. As a result, adopting recycling as an adaptation and mitigation alternative is highly successful; in addition to creating wealth while offering a source of income for millions, recycling operations may drastically decrease the quantity of solid waste which emits dangerous greenhouse gases. One of the main problems is integrating it into the regular waste management framework and providing safer, healthier conditions for work than a scavenger now faces at unmanaged landfills [48].

On the other hand, the liquid waste in Kano city was disposed into the ponds surrounding the city, which hold a huge quantity of the water resources distributed within Kano City. The waste was created by the burden of population growth, which prompted the excavation of land for building materials, in addition to wastewater treatment. This resulted in the infusion of effluents from homes and industries with a high concentration of chemical- and solid-waste materials, transforming them into unsightly and filthy areas with a strong odour. Numerous vectors of diseases, such as the snail causing Fasciola Hepatitis in cattle and sheep and Schistosomiasis (Bilharzias) bred at the location. Mosquitoes, which spread filarial worms, yellow fever, and malaria, were also abundant. Microorganisms that are pathogenic, like protozoa, fungi, viruses and enterobacteria, were fast spreading. The existing ponds also cultivated toxic compounds and plants (algal), resulting in several epidemiological outbursts of varying severity. In certain situations, the public health risk ranged from physical disability or impairment to mortality. Disease has had a devastating effect on the population. The existence of wastewater ponds within the society endangers the health of the general public. Nevertheless, measures are being made at the government, societal and individual levels to reduce the threat. The economic standing of the population, on the other hand, should be improved through all endeavors to teach the public the intended awareness. Regarding any significant actions of public health and environmental issues, scientific research should be supported and the findings of it adhered to [49]. This is all similar to the findings of this research, which states that solid waste was either used in landfill or taken to a central collection point for REMASAB to sweep and dispose of it. Meanwhile, liquid waste was disposed into the ponds and rivers, which caused more environmental harm. The availability of green building features and green building development and design are viewed as providing a good opportunity to maximize client/owner achievement by using energy-efficient, organizational levels of performance, and by minimizing building lifespan expenses in both Nigerian residential and commercial structures. To accomplish this, the customer has to be adequately educated on the advantages that will be gained in both the long and short term [37]. Similarly, the availability of green building features per dwelling in this research also shows that houses have more than one feature of green building. These features may include cross ventilation, a well, a courtyard, and energy-saving appliances such as bulbs, electric fans, etc., although most of the old versions of air conditioners and water heaters consume a high amount of electric energy in order to operate. The modern air conditioners come with an inbuilt inverter, which helps reduce the electric consumption.

The construction material used in most of these houses are cement bricks, as expressed in the results. The expensive nature of the cement bricks, along with their high heat conduction, makes them not sustainable, to some extent. However, their aesthetics and durable nature make the residents in Kano State use them in building their houses. The walls are later plastered with a mixture of cement and fine sand to insulate the wall from both sides, thereby preventing the rapid exchange of temperature from both the interior and exterior of the room. Roof insulation system responses were high in the study area, which helps maintain a reasonable temperature within the interiors during hot summers and cold seasons. Ref. [50] conducted three different experiments in Elazig, Turkey, into wall insulation which were installed in the middle on the outside and inside the building walls, so as to assess the effects of insulation thicknesses on the wall, depending on the places described earlier. For each insulation site, thermal properties such as heating and cooling transfer load, interval, and degradation factors were first established. The position of the insulation had no effect on the optimal insulation thickness. It has been observed that the highest temperature fluctuations and maximum loads in summer as well as winter occur when insulation was installed in the middle position inside the wall, whereas the wall with outer insulation had the least fluctuation. The insulation thickness is optimized using a cost study throughout the building's 20-year lifespan. For three different insulation sites, the optimal insulation thickness is discovered to be 8.2 cm. Ref. [51] stated that globally rising demands for energy and concerns for the environment mean that it is becoming critical that sources of energy must be utilized effectively. Building insulation saves money by lowering buildings' energy consumption. Building insulation, being a one-time installation, repays itself repeatedly in the overall life span of the building. Minimized energy use improves environmental sustainability. Thickening the exterior roof (ceiling) and walls reduces operational and fuel consumption expenses while raising investment expenditures. Another factor that raises the overall building expenditure is the use of cement bricks and plaster in the walls as the common building material in the study area. This material is expensive and not locally found within the study area, which results in substandard constructions (since, due to its expensive nature, the standard mixture of the cement and sand is altered) by the poor, and which become unsustainable. However, most residents in this area uses mud-brick walls plastered with cement mixture to strengthen it and prevent rain eroding the walls away. This is economically much cheap and closer to sustainability than using cement in the whole building.

Green building perceptions in this research presented the fact that most of the residents who had any green building elements were satisfied with them, even though most of these features require some enhancements to make them reliable and comfortable. For example, well and borehole water is hard and not safe for drinking and high-energy-consumption appliances like a steam iron and hot plate cannot be used with solar energy, despite their expensive nature. Extra efforts are required to alleviate these issues, through enlightenment on the easiest and most sustainable means of water treatment, desalination and filtration, solar cookers (or biogas for cooking), solar water heaters and alternative means of ironing clothes, etc. With this awareness, I believe these problems of satisfaction with the green sustainable building system will be improved.

5.1. Comparison with Saudi Arabian Green Building System

A large number of commitments among stakeholder participation regarding the degree of green building rating-system awareness in Saudi Arabia and the readiness to employ globally utilized rating systems like LEED and locally recognized systems like Mostadam were revealed by an analysis of the Saudi Arabian stakeholder's current level of awareness regarding the use and application of green building rating systems. Additionally, ref. [52] focuses on SDGs 6 and 7 in order to connect the findings to the Sustainable Development Goals (SDGs). The findings of some research demonstrate a high degree of understanding and agreement about the significance of water and energy conservation in green buildings which will employ Mostadam or LEED in Saudi Arabia and which will reach the SDG objectives.

Building sustainably is a reaction to environmental problems. Industries and businesses are evaluating the environmental impact of their operations. Researchers have identified the architecture, engineering, and construction (AEC) industries as critical areas for improvement, with an enormous opportunity to minimize environmental impacts. The AEC industries have significant effects on the environment and economy, and the sector is also one of the most significant contributors to greenhouse gas (GHG) emissions. Ref. [53] thoroughly examines and assesses the condition of Saudi Arabia's sustainable building certification systems in order to provide clear knowledge of the existing situation and potential future orientations. The scholarly research on Saudi Arabia's green/sustainable construction rules, standards, certification programs, procedures, and instruments is reviewed. It begins by talking broadly about sustainability. The investigation of sustainability tactics is followed by an examination of Saudi Arabia's building certification programs and an introduction to the new discipline of sustainable healthcare building assessment. Techniques for building information modelling (BIM) and life cycle assessment (LCA) have also been researched. A new version of the Saudi Building Code (SBC) is released, along with a new assessment of the SBC 1001-CR for green buildings. Additionally, it makes it abundantly evident how important sustainable construction techniques are and how necessary it is to create a certification program that takes current trends and regional conditions into account.

To draw attention to the challenges faced by green buildings and to identify the elements that may be used to mitigate these challenges, ref. [54] gathers data from earlier research, as well as employing a qualitative technique. This highlights the fact that hurdles and impediments are mentioned in the literature on green buildings under a variety of headings, including governmental, organizational, financial, managerial, operational, technological, and socio-cultural barriers. The majority of these obstacles have an impact on the creation of green buildings, in both direct and indirect ways. There are a number of crucial factors that must be taken into account in order to overcome these obstacles, such as the implementation of fresh laws and regulations by the government, the provision of incentives to industry in order to encourage businesses, and the development of a cultural collaboration among stakeholders in order to disseminate awareness and knowledge, information about green building, the sharing of success factors, and the sharing of critical cases in order to educate others. The development of green buildings, which will result in sustainable development in Saudi Arabia, may be aided by placing emphasis on certain elements or techniques. These findings can be used as guidance by project managers to guarantee sustainable development.

The addition of sustainability as well as green building standards to contractual construction-project contracts reflects the rising concerns of the majority of companies in hot zones. The goal is to produce a secure environment with occupant comfort, a healthy environment with the highest functional performance, and an efficient building that is also environmentally friendly. A comprehensive evaluation method for the composite façade of contractual contracts is developed in this research project [55], targeted at improving building energy efficiency in accordance with the sustainability rating system, with a particular emphasis on adopting active envelope-design energy applications. For an ongoing, one-of-a-kind case study project in Saudi Arabia, their research utilized technical evaluation with energy simulation-based PVsyst V7.1.0 software and contractual status evaluation. The Giftedness and Creativity Center project underwent a feasibility study for a sustainable active envelope employing the adopted specifications of the Building Integrated Photovoltaics (BIPV) façade item, rather than the contractual passive item. The project was included in the Leadership in Energy and Environmental Design (LEED) sustainability grading system. The findings showed that utilizing BIPV facades as an active renewable energy source improves the energy efficiency of buildings during the course of a project. Additionally, being a practically zero-energy enterprise, it produces 68% of the energy needed. Other benefits include cheaper costs than the winning bid without any contractual issues, annual energy savings, project upgrading to the platinum certificate, increased value of public investment, decreased CO_2 emissions, and the saving of barrels of oil.

5.2. The Impact of Green Building Awareness on Both Cost Implications and the Ecosystem

Green structures are at their finest when designers understand the composition, management, and structure of ecosystems and take into account how their architectural choices will affect the environment. Designers may produce architecture that purposefully interacts with a site's natural processes by applying the theories, practices, and lingo of ecology. The literal meaning of building design guidelines is implied by the development of assessment criteria. We can start to create a sustainable building stock if we set requirements according to our greatest empirical knowledge regarding ecological capability. For this, one needs to measure the relationship between the ecological effects that occur and their origin in the construction and usage of buildings. Conventional ecological-impact-evaluation approaches to building, which rely on assessing the expected adverse effects of human activities on the surroundings and frequently use a reference building that complies with building codes as a baseline to improve upon, do not do this. These indices lack an ecologically generated starting point, or acceptable measurement, which allows for the analysis and comparison of sustainable advancements on a global scale. Buildings' positive and negative effects may both be quantified using an ecological baseline. Additionally, this makes it possible to compare projects of drastically diverse sizes, kinds, and places on the same level. The idea of ecological capacities was expanded within the field of architecture, and its carrying capacity is being developed within its use as a space- and time-dependent instrument to assess the efficacy of green architecture [56]. The research into ecological resource criteria evaluates the sustainability of buildings using a measurable capacity for the carrying metric as a determined ecological baseline. To demonstrate the use of this technique, the farmhouse, a low-energy, organic material-based structure, is used. The corresponding materials and energy impact on ecological used are outlined, and practical methods for lessening the negative effects of conventional structures on the ecosystem are identified.

The study includes a thorough assessment of the literature on the factors that influence how green building techniques are adopted by those involved in the construction industry. The general motivations for stakeholders who want green building have discovered 64 different drivers. The study provides a methodology for categorizing green building drivers. Exterior drivers, property-level drivers, project-level drivers, individual-level drivers and corporate-level drivers are the five primary groups of green building drivers included in the framework. In terms of green building driver research, the dominant nations have been the US, Australia, the UK, India, and China [57]. Although here there is a need for additional in-depth research on the factors driving green development in developed nations, there is a lot more room for it in developing nations. This study will improve policymakers' and advocates' knowledge of the motivations behind green construction and contribute to the ongoing promotion of the idea. The list of questions and the structure of green building drivers in this study also provide academics with a strong starting point to further explore the subject and advance our understanding.

Natural materials used in buildings are in short supply and are restricted, due to the growth of the construction industry. Numerous studies have looked into how the construction material affects the environment. Building construction and usage are responsible for around 40% of the total emissions of CO_2, among which 15% are linked to the manufacture of building supplies. Thus, it has been crucial for the building sector to transition to a greener method of construction. Additionally, the overuse of river and natural sand, which is likely utilized as small particles in concrete, has a negative impact on environmental sustainability. Environmental harm is also caused by the creation of agricultural trash and leftovers. Agro waste will surely be generated after harvest and burned to clean up the trash in the area. Red-gram crops, paddy-husk, and sugar-cane, all produce agro waste that is 10–15 times more abundant than the real goods. In fact, it is preferable to embrace local and environmentally friendly alternative construction materials in order to satisfy the need for constructing building supplies [58]. Agricultural remnants have opened up the idea of using ecological substitutes in the erection of buildings. In this paper, we discussed the numerous potential uses of agricultural waste in the construction of buildings. Additionally, we have provided an assessment of the ecological, methodological, thermomechanical, and physical impacts. Using agro waste as building supplies has been shown to be a financially feasible technical option that might facilitate the utilization of biodiversity while ensuring energy security.

6. Conclusions and Recommendations

6.1. Conclusions

The world's demand for green building is increasing every day; this is because of the amazing features the green system has. The increasing dependency on public resources and the scarce nature of the public resources provided by the government and municipal service commercial companies, means that most of the buildings nowadays find it difficult to receive these public services for use. These public services include refuse management, pipe-borne potable water, electricity, indoor lighting and thermal control, and cooking energy sources, among many others. Therefore, if almost all the buildings around the world are able to provide independent basic needs for themselves using the natural resources nearby, more than half of the global warming issues will be resolved. This brings with it the need to raise awareness of green building around the world in an effort to alleviate the human disasters in search for shelter.

In Nigeria, evidence of green building has been found in many parts of traditional homes, particularly in Kano state. However, the majority of the GBs are diminishing in number due to the advancement of contemporary building designs, and many architects and clients choose contemporary building designs for new construction while neglecting the incorporation of green building features into the building (beginning from the construction processes and moving to the building plan and its usage). According to the study's findings, a lot of people rely on the unstable public electricity system, popularly known as KEDCO, which is a private electric supply company. Nigeria's chronic power issues spread all over the country, and Kano is not an exception. The situation is even worse when compared to Kano State's population and the overall electric megawatt supplied or allocated to the whole state. The lack of wall insulation in the buildings around the study area results in a temperature exchange with the external environment, because the majority of architects in Kano, Nigeria, have a lower participation rate in the design of green buildings. This further contributes to the state's existing environmental sustainability problems. In contrast, the majority of the nation's construction industries use high energy components like concrete, steel, combustion engines, etc. As a result, there is a significant demand for energy during the construction process, which increases the amount of energy required, the trash produced, the need for waste management, the risk of risks, and the global warming problems.

Government policies and regulations in building restoration, lower costs for building materials made from sustainable materials, government incentives, using energy-efficient equipment, awareness, and natural and environmental preservation are a few of the top sustainable-building drivers. The increase in building material costs is a result of Nigeria importing more building material supplies. The use of locally accessible and environmentally friendly building materials in Kano is rarely considered by architects. Most of these native structural components are inexpensive, easily accessible, and sustainable, using local construction materials, which are crucial as a sustainable method of lowering the price of constructing the overall building constructions. The majority of local building materials, however, are characterized by poor duration, poor durability and poor quality, which shortens the building's overall lifetime. More studies are needed in search of better ways of quality improvement of the current available native building materials we have around the country.

Also, fossil fuels used as a heat and electric sources in most of the buildings during the winter were preferred by the residents; these involve using firewood, petrol, kerosene burning or combustion. This is regarded as unsustainable, since it causes deforestation for firewood, pollutes the air, harms human health, and harms other habitats within our environment. Although, there is significant interest from the residents in Kano who express their willingness to use green construction/building and were satisfied with it, additional efforts are required to discourage the use of fossils and encourage the use of renewables to meet the next sustainable targets.

All the aims and objectives of these research studies were met in this research; these objectives were to determine the satisfactory perception of users, its existence in Kano, its significance, and the raising of public awareness of green building in the city. Is therefore concluded that the Nigerian government at the national level should put more effort into encouraging green building construction through public awareness programs and incentives and subsidizing the green system. Meanwhile, at the local and individual level, stakeholders, property owners and tenants should join the effort, along with non-governmental organizations (NGOs) to promote and utilize the benefits of the green building system.

6.2. Recommendations

In order to resolve various sustainability problems in green construction, it may be appropriate to use a comprehensive approach to achieve building sustainability. An effort to achieve sustainable growth in a country is expected to attain a good socioeconomic position and environmental sustainability in the society. Green building will help in achieving the sustainable goals every country requires for steady development. Among the numerous features of GB we have seen in this research are energy efficiency, cost-saving, and environmental friendliness. Therefore, the Nigerian government should encourage GB practice to help address the country's housing sustainability issues. It is crucial to motivate the public by highlighting its significance and encouraging stakeholders, clients, architects, and users to use these green elements in their architectural designs and to persuade them to invest more in green construction. This could assist society in acquiring a green structure at a reasonable price, while removing damaging human activities from the environment around the nation. Similar to addressing this, the state government and estate investors must join their efforts to integrate their initiatives to highlight the incorporation of green elements into building development, and the numerous financial benefits of an energy-efficient, environmentally friendly, and low-cost building maintenance.

The heavy load on the public power supply and the limited energy supplied is not enough to serve the buildings in the Nigerian nation. This is caused by rapid population expansion, making the country's electricity shortage worse every day. Rapid urbanization and several construction projects are being undertaken to house the huge population in the city, which is among the current problems encountered in Kano state. When energy-efficient buildings are constructed using locally available materials which are cost-effective throughout both the construction and completion stages, this will alleviate the housing demands and sustainability issues. Therefore, passive houses are strongly suggested as a solution to these sustainability challenges. The cost savings can be seen for water and electricity bills, as well as for heating and cooling the indoor environment. It is recommended in this research to use renewable sources for both heating and cooling energy, water sources, and even the construction materials, in order to reduce both the construction and building utility costs. The government's evaluation of housing policy in relation to green development is strongly advised. The requirement that local building materials be used in residential structures, the promotion of public education campaigns, and the encouragement of green building through the provision of financial incentives to the populace are necessary. Nevertheless, the government should increase the state's current refuse management system (REMSAB) and provide more central collection-station points. Landfill and pond-fill should not be avoided, and should not be exploited as dumpsites for waste. Similarly, garbage burning should be discouraged and waste recycling and reuse encouraged. To ascertain the precise overall number of green buildings in Kano State, more investigation is recommended.

6.3. Contributions of This Research

This research was able to contribute knowledge towards green building development in Nigeria. This includes the identification of the existence of GB and the examination of a sample building in Kano State. The significance of green building in general was highlighted in this paper, which shows the impossibility of achieving global sustainability without the system.

The perception of green building users in Kano State was evaluated using a questionnaire, and the results were satisfactory. This means that green building was able to satisfy the needs of its users and provide the basic needs necessary to support life and achieve human survival and shelter needs on Earth. Likewise the awareness of green building in the city is reported to be high and remarkable, which indicates that the respondents in this research were already aware of the advantages of green building in the study area. This means that when given the required support for green building, the people are willing to accept and put it into practice it in the country, which will help improve the economic situation of the nation.

This research was able to identify the drivers that will improve the practice of green building and the barriers which will hinder green building development. These drivers are the use of local construction materials, renewable energy, energy-saving appliances, government incentives, roof and wall insulations etc., while the barriers were the use of imported construction materials, architects constructing expensive conventional buildings, the use of high-energy-consumption devices, the use of fossil fuels, etc.. Drivers can be categorized into economic, cultural, and social, and environmental sustainability.

6.4. Limitations

The limitations of this research were many; this is because there are strict privacy issues with most of the residents in this region, as they are religious, and also because of the cultural norms. Men are not allowed to enter the houses to make personal observations, and this limits the research to questionnaire studies. Financial constraints also limit the studies, because the research uses a lots of funds to travel back to Nigeria from Northern Cyprus to conduct the studies, which makes it difficult to find sponsors. While time constraints were also among the limitations, the researcher was still able to work hard to overcome this issue, and met with the specific time for completion.

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