



ASHESI UNIVERSITY

**INVESTIGATING THE FEASIBILITY OF COST-EFFECTIVE BUILDING
ALTERNATIVES FOR LOW TO MIDDLE-INCOME EARNERS IN GHANA: A
FOCUS ON MADINA**

Undergraduate Thesis

By

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Undergraduate dissertation submitted to the Department of Business
Administration, Ashesi University. Submitted in partial fulfilment of the
requirements for the award of Bachelor of Science Degree in Business Administration

Supervised by Dr Takako Mino

MAY 2020

DECLARATION

I hereby declare that this thesis is an original research paper and that no section of this paper has been presented for a degree in this university or anywhere else.

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I hereby declare that the preparation and organization of this thesis was conducted per the guidelines on supervision of thesis laid down by Ashesi University.

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ACKNOWLEDGEMENT

My uttermost gratitude is to the Lord Almighty. His grace and mercies kept me through my stay in Ashesi and the successful completion of my thesis is one of my biggest stories thus far. To my father, Mr. Thomas Adoboe who constantly encouraged and supported me together with my mother, Mrs. Patience Adoboe, deserves my deepest gratitude.

I appreciate my man of God, Bishop Charisma Evangel, for aiding me in choosing the appropriate topic for my dissertation. I am thankful also to my former supervisor, Dr. Sena Agyepong for her advice and constant correction. I am grateful to Dr. Takako Mino, my present supervisor for her encouragement and perfect guidance. I was blessed to have you as a supervisor. And to my co-supervisees, Lydia Adobea Dampare Addo and Marie-Dolores Ako-Adounvo, I say thank you for proofreading this thesis, your additions, subtractions, and assistance to this paper has helped me submit complete research. God bless you all.

ABSTRACT

Annually, Ghana battles with a constant increase in the housing deficit due to the unaffordability of homes, This is mainly caused by the price surge of building materials. The prime objective of the research was to identify cost-effective building materials and examine these building materials. The research question the paper aimed to answer is, “what alternative building materials can be applied in Ghana?”. This research investigated housing affordability in Ghana specifically the city of Madina. The research paper employed the use of quantitative methods to investigate the perspectives of households in Madina on the construction of the recommended alternative building materials. The sampling size used was 300 inhabitants of Madina with the help of the Taro Yamane formula. Questionnaires were handed to 300 selected participants. The data was collected and analyzed in Excel. It was revealed that the respondents were interested in the cost-effective building materials, especially prefabricated materials because they believed it had a better aesthetic appeal compared to the shipping container and the plastic brick. The thesis concludes with a recommendation on real estate developers and the government considering the exploration of cost-effective building materials such as the prefabricated materials since individuals in Madina are interested in them.

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LIST OF ACRONYMS

GREDA – Ghana Real Estate Developers Association

GSS – Ghana Statistical Service

UN – United Nations

CHAPTER ONE: INTRODUCTION

1.1 Introduction

According to the Executive Secretary of Ghana Real Estate Developers Association (GREDA), Samuel Amegayibor, about 85% of Ghanaians may not be able to afford homes in Ghana (Daily Guide, 2018). With an annual growth rate of 2.2% in the population, it is vital to consider the housing situation of Ghana (Ghana Statistical Service (GSS), 2012). Defined by the United Nations (UN), a house is a structural place of abode to prevent a person(s) from being harmed by the climate such as the sun and storms. The housing deficit of Ghana stood at 2 million housing units in 2010, which shows that many people lack access to homes (Ghana Statistical Service, 2012).

Furthermore, concerning the Sustainable Development Goal 11 (sustainable cities and communities), the UN (2015) identified that 828 million people were living in slums. This goal explains that affordable housing is a necessity for all.

Therefore, this research sought to explore making houses more affordable by using cost-effective building materials. This research sought to understand affordable housing in Ghana, how it can be determined, and if there are housing alternatives that can be applied by real estate developers or the government to help decrease the current housing deficit in Ghana. Specifically, it focused on the case study of the housing situation in Madina.

1.2 Background

1.2.1 Affordable housing in Ghana

An investigation carried out by Boamah (2011) illustrates that affordable housing constitutes not just a physical structure but also indicates the quality of living. Therefore, the building is not the only consideration. It also involves a wide range of our climate and our surroundings such as ventilation, good road access, sanitation, the cost of the mortgage, to mention but a few. All these contribute to making one feel secure in a setting. Boamah further added that quality affordable housing is essential to every nation as it protects individuals against the harsh weather conditions and has a general effect on the efficiency and stability of the economy of the country as a whole.

According to the Ghana Statistical Service (2012), Ghana suffered a housing deficit of 2 million in 2010, and it is estimated to grow every year with a demand of 133,000 units per annum. Nonetheless, about 25,000 houses are constructed yearly, according to Ghana Statistical Service (2012). This does not satisfy the growing demand for housing per year. Konadu-Agyemang (2001) stated that housing affordability is determined by the economic situation of a country, household income, and the cost of houses in the country. He further observed that the cost of housing in Ghana was of growing concern to citizens, as it has led to the inability of individuals to purchase a secure home.

Housing has gone through a series of development over the past decades. Ghana has witnessed several interventions that have been initiated by non-governmental organizations, real estate developers and government bodies to curb the housing issue (Kwofie, Adinyira & Botchway, 2011). The first historical intervention of a government body in the housing industry in Ghana was recorded

when Governor Guggisberg's administration introduced the Dispossessed Persons Housing scheme in 1923 (Kwofie et al, 2011). The scheme was set up to provide houses for citizens who were dispossessed due to government developmental programmes (Kwofie et al., 2011). The government gave out loans for individuals to finance the construction of their homes. However, the government deemed it to be too expensive; therefore, the scheme came to a halt in 1933 (Konadu-Agyemang, 2001).

The post-independence era saw several interventions under the regime of Dr. Kwame Nkrumah. This included the Tema Development Corporation (TDC) in 1952 and the State Housing Corporation (SHC) which was established in 1956 (Kwofie *et al.*, 2011). The main aim of the TDC was to provide relatively affordable homes for low-income earners in Tema, while the SHC was to provide finance housing and homes for public and civil workers (Konadu-Agyemang, 2001). The second development plan which was proposed in post-independent Ghana to continue with the provision of houses from 1959 to 1964 failed to materialise because there had not been a needs assessment. Consequently, the scheme was aborted because there was no indication of projected targets and outputs in the development plan (Gyabah, 2009).

Under the Rawlings regime in the 1980s, Ghana adopted the Structural Adjustment Programmes (SAP) of the World Bank, to help the country receive sufficient funds to boost the housing industry in Ghana (Kwofie *et al.*, 2011). The government was required to participate in trade liberalization, which made the market open to importing building materials. This led to the loosening of rent controls (Benjamin, 2007). This trade liberalization eventually resulted in high inflation, high cost of construction, and high rents. Through this, the development of ghettos and

slums were increased because of the high, unaffordable rent prices (Gyabaah, 2009). The Kufour government wanted to alleviate the rising housing crisis by building 20,000 affordable housing units in 2001. In 2007, about 4,500 housing units were started; however, these housing units were not completed, and the scheme was discontinued by the new opposition government, which took office in 2009 (Nelson & Ayeh, 2009).

Apart from the government providing homes for the citizens, the private sector, including GREDA, provides about 80% of housing units in Ghana (Addo, 2014). Additionally, mainly as an answer to the eviction problems the people of Old Fadama faced, a community-based Non-Governmental Organization (NGO), Habitat for Humanity, and People's Dialogue, intervened, contributing to a small supply of the housing stock (Afenah, 2010).

From the foregoing discussion on housing initiatives, it can be concluded that several interventions have been put in place to deal with the housing deficit in Ghana. Although some of these interventions may have worked at some point, they were not sustained. Hence, Ghana still faces housing challenges. This study, therefore, sought to find ways of tackling the housing deficit by exploring the use of alternative building materials in Ghana.

1.3 Problem Statement

The ability to provide affordable homes for the majority of the citizens remains an issue in most countries, especially Ghana (Afrane, Bujang, Liman & Kasim, 2016). Although there have been interventions by past governments, the country still faces a housing shortage which poses a socio-economic challenge (Ghana Development Plan, 2008). In 2007, the New Patriotic Party undertook an

initiative to build affordable homes at Borteyman and Kpone in Accra. However, the scheme was discontinued by the succeeding government (Ansah & Ametepey, 2013).

Under the “Coordinated Programme of Economic and Social Development Policies, 2010 to 2016” by the National Democratic Congress, it was highlighted that secure housing would increase by 6% in 2020 with the need to find alternatives to increasing affordable housing in Ghana. Danso and Manu (2013) indicated that the rising cost of houses in Ghana was as a result of the increase in prices of building materials. As stated by Gorin (2017), as the price of raw materials increases, the price of the output, which is the price of the homes will also increase. This provides an understanding that building materials are one of the significant factors that contribute to the unaffordability of homes in Ghana. Addo (2014) recommended that cost-effective housing alternatives should be explored to help with affordable housing in Ghana.

From the above information, we understand that Ghana currently faces a housing shortage, and one cause of the increasing price of houses is building materials. Therefore, the problem identified is the rising prices of building materials. As suggested by the Coordinated Programme of Economic and Social Development Policies (2010), there is a need to explore other building materials alternatives that will help with affordable housing in Ghana. Therefore, with this issue identified, the research paper undertook this study to find alternative building materials that would reduce the cost of housing.

1.4 Scope of the Study

The research focused on cost-effective housing alternatives that are being used around the world and can be applied in Ghana. The study provided a brief overview of the present housing in Ghana. This research covered what affordable housing means in Ghana and an evaluation of the housing alternatives that can be explored. It examined the pros and cons of these housing alternatives. The research focused on Madina as a scope of the study.

1.5 Justification of the Study

As discussed in the problem statement above, Ghana faces a housing deficit with homes in Ghana being expensive (Konadu-Agyemang, 2008). This research sought to discover different means of making housing in Ghana more affordable.

Additionally, in the literature review (Chapter 2), the gap in the literature was identified to be that research on other building alternatives has not been explored in Ghana. The housing situation in Ghana as suggested by Addo (2014) can be tackled by reviewing cost-effective building materials to reduce the cost of housing in Ghana.

1.6 Objectives

This research aimed to investigate housing alternatives that can be used in Ghana to guarantee affordability. To achieve this aim, the study sought to:

- Identify building alternatives that are adopted to ensure low cost of housing globally;
- Extract which alternatives could be adopted or adapted for use in Ghana;

- Solicit the views of both renters and house owners on the use of these building alternatives; and
- Make recommendations for the adoption of these housing alternatives that can make housing more affordable in Ghana.

1.7 Methods

This research evaluated the possible housing alternatives that could be adopted by the government or private investors in the real estate industry to tackle the housing deficit for low to middle-income earners. As explained by Yin (2003), a case study methodology should be employed when you cannot manipulate the behaviour of the participants and to answer why questions. The study employed the case study methodology because participants could further explain their housing preference without being influenced also. This provided the opportunity to give a better context to the research. Madina was selected as the case study because it houses both low to middle-income earners, who are also the focus of this research. The research question that guided this research topic is ‘What alternative building materials can be applied in Ghana?’ From this research question, building material alternatives that can be constructed in Ghana were identified.

This research will enable individuals, the government, and real estate investors to know the housing alternatives that can be applied in the country. The impact of the research would lead to finding the possible construction materials that will benefit the low to middle-income earners in the country. The various stakeholders that would be involved in this research are the government, real estate investors, real estate developers, and the general public.

The methodology used was the quantitative methods. The quantitative methods were used because there was a need to understand if inhabitants of Madina would be interested in the suggested alternative building materials. Data from individuals who live in Madina was gathered through self-administered questionnaires.

This research was organised into five chapters. Chapter one introduced the study. It presented the background to the study, the problem statement, the objectives, the significance of the research, and the organisation of the research. The second chapter reviewed existing literature on affordable housing. The methodology, which is the third chapter, described the steps that were taken to achieve the objectives of the study, and this included the type of research, data collection methods, and methods of data analysis. The fourth chapter focused on processing, analysis, and, presentation of findings. Last but not least, chapter five provided conclusions and recommendations based on the results of the research.

1.9 Conclusion

This chapter identified the need for housing in Ghana and some interventions by past governments. The problem identified is the increasing price of building materials in Ghana that has led to the increasing price of homes. Ghana currently faces a housing deficit; therefore, there is a need to provide homes at affordable prices for low to middle-income earners. This research aimed to analyse housing alternatives that can be used in Ghana to guarantee affordability. Therefore, the quantitative method was used to analyse the data that were collected via surveys.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter consists of literature that contributes to the understanding of affordable housing in Ghana and the use of housing alternatives with a focus on housing materials. It also draws insights from interventions around the world concerning affordable housing with the use of different housing materials as the solution. The chapter identified a gap in the literature, with affordable housing being an issue in Ghana. Also, the current housing situation in Ghana can be tackled by investing in other building materials that were discussed in this section.

2.2 Housing as a Need

Shelter is one of the essential components of an individual's survival. In a 1943 paper, "A Theory of Human Motivation", Abraham Harold Maslow, an American psychologist proposed a theory popularly known today as Maslow's Hierarchy of Needs, which propounds a sequence through which motivation for humans occurs (Maslow, 1943). The pyramid helps to comprehend which of the needs are more critical to a man to drive motivation. The basic needs a person requires, according to Maslow (1943), includes physiology and safety needs. The physiology needs include water, food, shelter, health, and clothes to mention but a few. The pyramid indicates that before a person can move to the next level which is safety, he or she is supposed to be able to attain the first level, which is physiological needs such as food and shelter.

Maslow's theory has come under criticism from different individuals. For example, Tay and Diener (2011) believe that Maslow's Hierarchy of Needs varies with age and the needs of the individuals may not be the same across the various age

groups. However, for this research, Maslow's Theory will be considered because it reveals the importance of shelter as a basic need which is essential to this research.

2.2.1 Madina as a Case Study

Madina was one of the largest and most populous settlements in the region of Greater Accra, Ghana (GSS, 2012). The main economic activities the inhabitants of Madina engage in are trading, agriculture, and manufacturing (GSS, 2012). The total population of Madina was 111,926 individuals, with about 48.5 percent being males and 51.5 percent being females (GSS, 2012). The population of households in Madina 2010 is 108, 051 in 2010 (GSS, 2012).

With a population of more than 100,000 individuals, Madina is an urban area where low to middle-income earners may reside (GSS, 2012). Since the research is focused on both low to middle-income earners, Madina would be a suitable site for a case study on affordable housing.

2.3 Interventions by Government

In pre-independence Ghana, there was the establishment of public housing by the government. The Guggisberg Administration provided homes to dispossessed individuals due to government development programs; loans were provided to individuals to allow them to construct homes. However, the scheme was discontinued as it was deemed too expensive (Konadu-Agyemang, 2001).

Post-independence Ghana has also witnessed several interventions to address the housing deficit in Ghana. The Ghana Vision 2020 Scheme under the Rawlings government from 1993 to 2001 was aimed at providing homes for low-income

earners (Konadu-Agyemang, 2001). However, the unavailability of funds and the introduction of the private sector into real estate brought the scheme to an end (Konadu-Agyemang, 2001). Moreover, the Kuffour government also targeted public and civil servants to provide them with low-income houses; unfortunately, this project was discontinued by the succeeding government (Konadu-Agyemang, 2001).

2.4 Housing Affordability

As stated in the introductory chapter, some interventions have been made by past governments in both pre- and post-independence. Currently, the Ministry of Works and Housing (2017), in their budget review, stated that the housing projects in Kpone, Borteyman, and Saglemi are said to be completed or partially completed. The houses that were constructed by the government at Borteyman are estimated to cost about GHS 87,000 (USD 15,743.24) to GHS 150,000 (USD 27,143.51) (Ministry of Works and Housing, 2017). It is expected that if houses are being constructed by the government, they would be more affordable since the government does not seek to make a profit. However, the minimum cost of a home built by the government at Borteyman is GHS 87,000, which if the median multiple was to be applied in this context, the majority of Ghanaians might not be able to afford it. The median multiple (section 2.4.1), when calculated, is 25.564, which is described by the World Bank as being unaffordable. The median multiple is further explained in the Median Multiple sections.

Konadu-Agyemang (2001) argues that the term affordability has a vague description, hence “affordability” may have varying meanings in different countries due to socio-economic conditions. He further establishes that the majority of lending institutions and housing agencies calculate affordability based on the relationship

between house prices and household income. Therefore, the acceptable ratio of the house price to the annual gross income is 1:4 or 1:6. Thus, households are not expected to spend more than 28% of the pre-tax household income (The Wall Street Journal, 1997). Although this rule of thumb originated from Great Britain, it is said to be outdated. However, it is still practised in some situations (The Wall Street Journal, 1997). Konadu-Agyemang believes that in Western Countries, it is considered that spending more than 28% of gross income concerning housing prices is excessive. Therefore, this situation would be worse in developing countries where incomes are low, and only feeding and related expenses take a more significant proportion of their household income.

Bhatta and Basudeb (2010) describe affordable housing as when those with a low median household income (as decided by the government or a general housing affordability index) can afford a home. The National Affordable Housing Summit Group in Australia (2012) defines housing affordability as “reasonably adequate in standard and location for lower or middle-income households and does not cost so much that a household is unlikely to be able to meet other basic needs on a sustainable basis.” Since there is little information to determine how housing affordability is determined in Ghana, it is assumed from Konadu-Agyemang’s argument that there is a general criterion that is being used, and this criterion does not work in Ghana because the majority of a person’s household income is focused more on food than on getting a house (Konadu-Agyemang, 2008).

2.4.1 Affordability Index – Median Multiple

According to the GSS (2012), the mean annual household income in Ghana is GHS 6,571.80, which implies that such a household may survive on about GHS 18.00 per day. To further support this, the World Bank recommends the use of the

median multiple, which is the ratio of the average house price to the annual gross household income. According to the Ghana Investment Promotion Centre (2013), the average price of a house is GHS 168,000.00. Therefore, in calculating the

Table 1

Demographia International Housing Affordability Survey: Housing Affordability Ratings.

Housing Affordability Rating	Median Multiple
Affordable	3.0 & Under
Moderately Unaffordable	3.1 - 4.0
Seriously Unaffordable	4.1 - 5.0
Severely Unaffordable	5.1 - Over
N.B – Median Multiple is the median house price divided by median household income	

Note: This table was derived from Demographia (2018)

affordability of houses in Ghana using the median multiple, it will be $168,000/6,571.8 = 25.564$. The International Housing Affordability Survey says if the rating is above 5.1, it means housing is severely unaffordable. In this case, the rating is 25.564, which indicates that housing in Ghana is unaffordable. These definitions and calculations support Konadu-Agyemang's argument that housing in Ghana is unaffordable.

Furthermore, the Demographia International Housing Affordability Survey (2018) in the 14th annual research, declared that Hong Kong had the most unaffordable housing market as it had a median multiple of 19.4 with Australia being the second highest with a median multiple of 5.9. This gives an idea as to how housing is unaffordable in other countries as compared to Ghana.

Demographia (2018) further states that one of the leading causes of housing unaffordability in countries such as Hong Kong, Australia, Canada, among others, is due to the increasing land prices. The cost of such lands results from the expensive infrastructure fees and the highly strict regulations of the use of land. Also, Demographia (2018) states that due to the strict land-use regulations in countries such as Australia, and New Zealand, the market is unable to provide low-cost housing, and this has led to a price escalation in these countries. However, in some cities in the United States, they can supply houses quickly by having them built at a fast rate and selling them at a more affordable price through the open market-based land structures, where there are less strict land regulations; therefore, this prevents prices from increasing as opposed to countries such as Australia, and Canada, where there are stricter land regulations (Demographia, 2018).

2.5 Major Factors for High House Prices

Danso and Manu (2013) expressed that the high cost of building materials and land acquisition served as significant challenges for construction companies. From their research, they established that about 60-70% of the cost of the building was attributed to the building materials, while the cost of land followed the cost of building materials as the second most expensive item in constructing a home. They believe that this factor of a high cost in building materials has contributed to the housing deficit in Ghana. Therefore, having a suitable home is beyond the reach of the majority of the population. This claim was further supported by Emoh and Nwachukwu (2011) who observed that the increasing prices of building materials in Nigeria prevented the low to middle-income earners from owning affordable homes.

Additionally, research conducted by Asibuo (1994) indicated that building materials account for about 50% of the cost of construction in Ghana. These arguments point to the fact that building materials in Ghana are expensive and therefore, as suggested by Addo (2014), further research should be conducted to develop more solutions that would help to reduce the housing deficit in Ghana. This research, therefore, focused on finding cost-effective building materials since the above literature has established that it is a leading cause of the increasing prices of homes in Ghana.

Also, Danso and Manu (2013) affirmed that one factor that has led to an increase in the cost of building materials is the importing cost. He believes that there is high patronage for foreign materials such as Portland cement, which has caused an increase in the price of building materials in the country. From his findings, he recommends that there should be the use of local materials such as sand, grass, thatches, and clay because these raw materials are less expensive.

However, Venkatarama and Prasanna (2009) explained that these materials (sand, grass, clay, etc) are not durable and, therefore, will require much maintenance, especially after the wet season. Venkatarama and Prasanna (2009) revealed that the buildings made out of such materials (sand, clay, thatches) would need to be reinforced with these materials after the wet season, leading to an increase in the overall cost of the building in the long run. Also, it is said to be labour-intensive when building with raw materials such as sand. There is the need to always pay these labourers anytime the building needs to be strengthened with the materials. This is because, after the wet season, the rains can weaken the structure. This could be a reason why individuals may prefer to build with cement blocks which may require less maintenance after initial construction.

One of the significant reasons for an increase in the price of homes in Ghana is the increase in the price of building materials. Identifying this cause explains why homes in Ghana are quite unaffordable. Therefore, this study details out how to increase the affordability of homes by finding alternative building materials that can be constructed in the country.

2.5.1 Contributing Factors to House Prices in Ghana

A field survey undertaken by the Ghana Real Estate Developers (2007) ascertained that the factors that influence the price of houses are high-interest rates, cost of inputs, infrastructure, legal framework, access to land, land litigation, access to credit and high labour costs.

However, from the information provided, it was suggested that the majority of the participants that took part in GREDA's survey, agreed that the cost of inputs was the primary factor that influenced house prices. It was followed by access to credit, land tenure, land litigation, legal framework, infrastructure, cost of labour, and high-interest rates. Moreover, a similar survey conducted by GREDA (2007) on the major causes of house price increases suggested that about 86% of the participants indicated that building materials were the paramount cause of house price increases. The high cost of land came in second as a significant factor for house price increases, while high labour costs, high-interest rates, and inefficient technology followed suit. From this survey, it was concluded that the cost of building materials was the driving force behind the increasing house prices in Ghana.

2.6 Interventions around the World

Various countries have tried to address the housing issue in their countries, and through continuous research, innovative developments are being introduced while some existing cost-effective solutions are being developed. Through innovative developments and research, cost-effective solutions are being used by various countries to address their housing deficit issue.

Pre-fabricated homes, also known as modular homes, is when components of the building are made in the factory and sent to the site for assembling (Panjehpour & Abang-Ali, 2013). The idea of pre-fabricated homes originated from post-World War II when the U.S government was mandated to produce about 850,000 homes in less than two years. In considering cost and time, pre-fabricated homes are said to have some of the following benefits. According to Panjehpour and Abang-Ali (2013), it can take two days to construct a pre-fabricated home as the parts are already manufactured, while site buildings can take more than six months to complete. Pre-fabricated homes also help to reduce labour costs and contribute to a cleaner environment.



Figure 1: Picture of a prefabricated house (Karmod.com, 2016)

According to Navaratnam, Gunawardena, Henderson, and Ngo (2019), cost and time are very vital to both consumers and manufacturers. From their research, pre-fabricated homes cost significantly less than conventional means of constructing homes. In countries such as Sweden, the market share of pre-fabricated building systems is more than 80% (Navaratnam *et al.*, 2019). Australia is slowly accepting the use of pre-fabricated buildings by constructing apartments and health facilities in some parts of the country and manufacturers have testified that construction time reduced by 40%, while labour costs reduced by 20%. Also, CO² emissions were said to have reduced by 50% in prefabricated homes (Paya-Marin & Sengupta, 2013).

In 1952, Ghana opted for the construction of prefabricated buildings. however, the programme failed (Essienyi, 2011). According to Essienyi (2011) study conducted proved that the cost of providing prefabricated buildings was more expensive than the government estimated it to be. Nonetheless, the construction of the prefabricated buildings has worked effectively for countries such as France and Austria (Essienyi, 2011).

Essienyi (2011), in his research, stated that one of the reasons the construction of the prefabricated buildings failed was due to the lack of support for the economic and social structures. Unfortunately, during the period the idea of the pre-fabricated buildings was proposed, the country had not budgeted to spend the required amount needed to construct the prefabricated houses (Essienyi, 2011). Also, the company they were collaborating with from Holland, demanded that about 9,000 houses should be constructed annually (Essienyi, 2011). Moreover, Ghana did not have the appropriate infrastructure to support the building of these houses as it was required that the government constructed factories to produce the prefabricated materials (Essienyi, 2011).

Also, Essienyi (2011) surveyed about 15 middle-income Ghanaians to understand their views on pre-fabricated houses. 33% of the participants declared their interest in prefabricated buildings. Essienyi (2011), concluded that the perception of prefabricated homes prevented some Ghanaians from considering the prefabricated buildings. Essienyi (2011), further affirmed that 67% of the participants believed it was the culture of Ghanaians to have a home built out of cement.

Therefore, with further research and a little education on prefabricated materials, Ghana can make strides in adopting prefabricated buildings. Prefabricated buildings have proved to be efficient for some developed countries,

A Colombian company called Conceptos Plasticos has explored the use of waste materials, including plastics to build homes in their country (Lauvergnier, 2016). In a publication by Lauvergnier, she cited the co-founder of Conceptos Plasticos, Oscar Mendez, who stated that in two years, the company was able to recycle 160 tonnes of plastic and build 1,400 square meters of housing for displaced individuals. The plastics are brought in to the factory, where they are ground, melted, and poured into moulds (Mendez, 2016). Additives are added to make the plastic more heat resistant, and these moulds are placed in cold water to produce a thermic shock (Mendez, 2016). They can produce materials that are light and relatively flexible, yet can withstand earthquakes (Mendez, 2016).



Figure 2: Picture of a house made out of plastic bricks (Conceptos Plasticos, 2016)

The building of the homes does not need skilled workers, and anyone can learn how to build such homes in less than a day (Mendez, 2016). It requires stacking the moulds like Lego blocks on top of each other, and it can take four people to build a forty-square meter house in five days. According to Mendez (2016), these homes cost about 10-20% less than the cost of homes in rural areas. Moreover, this building material is less polluting; there is low labour cost as it does not require skilled workers, and also the materials are recycled.

Research conducted by Mensah, Obiri-Danso, Miezah, Kadar, and Fei-Baffoe (2015), revealed a major waste problem in Ghana. Their study disclosed that 12,710 tons of waste per day are produced from a population of 27,043,093 million Ghanaians. These waste materials can be recycled and translated into bricks for the construction of homes as suggested by Mendez (owner of Conceptos Plasticos). The adoption of this method can eventually help reduce the amount of waste in the country while providing homes for the low to middle-income earners in Ghana.

Addis (2006) would agree that although individuals express concern in reclaiming and reusing materials, little progress has been made to use reclaimed materials in large projects. In a case study by Eklund, Dahlgren, Dagersten, and Sundbaum (2002), two projects were undertaken in Sweden to demonstrate the benefits of using reclaimed materials. From the project, the contractors indicated that although it was their first time being involved in such a project, they foresaw such projects that involve using reclaimed materials to cost 10 – 20% less than conventional means of constructing homes.



Figure 3: Picture of a house made out of shipping containers (The Shipping Container, 2018)

Smith (2006), explores the use of shipping containers as building components to reduce cost. He first identifies the issue some countries face with meeting their housing demand, and the cost of construction was one of the factors that were identified. Smith (2006) proposes that although shipping containers are not aesthetically pleasing, they can help to reduce the cost in a building. In Amsterdam, about 1000 student homes were constructed using shipping containers from China (Oloto & Adebayo, 2012), while in London, a firm completed the construction of numerous building projects using shipping containers (Oloto & Adebayo, 2012). From the research by Oloto and Adebayo (2012), the majority of building professionals in other countries such as Amsterdam, China, and London, stated that houses made out of shipping containers are a cost-effective method of building homes.

A downside to constructing homes out of shipping containers is that Ghana is found in the tropical zone (Kpodo-Tay, 2019; Liczano, McSweeney & New, 2008). Shipping containers are known to be very warm. therefore, it would require

insulating the building with fibre glass to reduce the amount of heat that is trapped in the building (Kpodo-Tay, 2019).

Although some countries such as Australia and the United Kingdom were hesitant to adopt these alternative building materials such as the shipping containers and the prefabricated buildings; they testified that the use of these building materials in some projects in these countries have helped to reduce the cost of building (Navaratnam et al., 2019).

The purpose of this research is to identify alternative building materials that can be applied in Ghana to guarantee housing affordability in areas such as Madina. Therefore, the above information reveals alternative building materials constructed in other countries and their impact in some of these countries. This knowledge contributed to this research as it signified that these alternative building materials can be constructed in Ghana.

2.7 Theoretical Framework

A theoretical framework was developed from the work of Konadu-Agyemang (2008) to aid in the understanding of this study. Konadu-Agyemang's (2008) work sheds more light on the housing situation in Ghana. From his research, he reveals Ghanaians sentiment towards the high cost of houses in Ghana. Danso and Manu (2013) also contribute to this theoretical framework by disclosing how the high cost of homes is also attributed to the high cost of building materials.

Asiama (2006) asserted that there are some vacant homes in areas such as Airport Residential area which the owners are waiting for tenants to pay higher amounts in foreign exchange. Also, some of the houses at Kpone and Borteyman

were vacant after they were constructed, which is believed to contribute to the housing situation in Ghana.

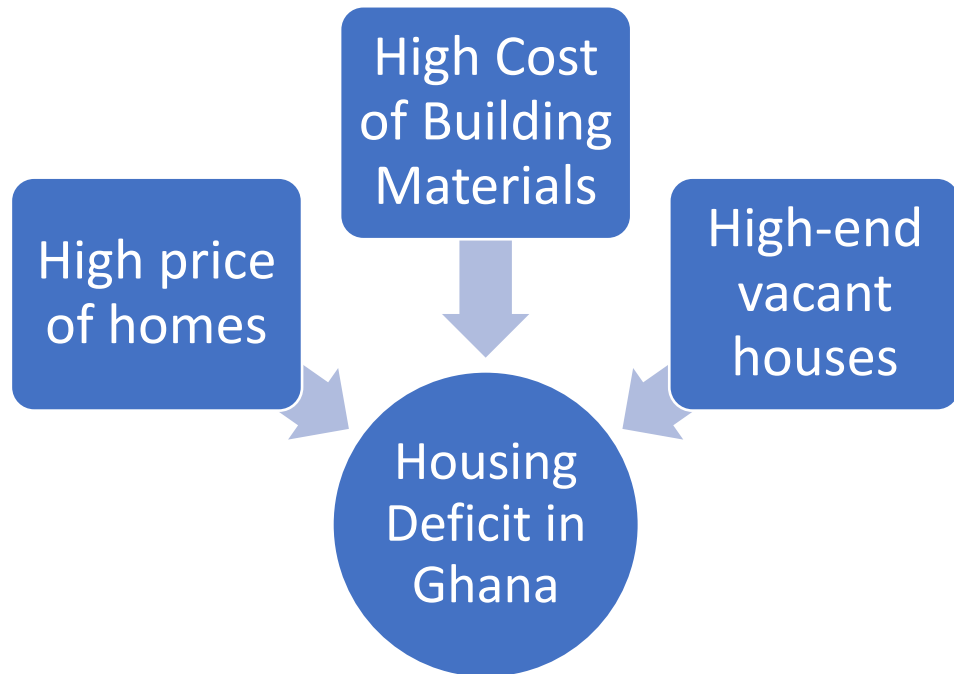


Figure 4: Housing Situation Identified.

2.8 Conclusion

Based on the literature obtained, it is inferred that one of the leading causes of high prices in Ghana is the high cost of building materials in the country. From the research of Konadu-Agyemang (2008) and the median multiple of Ghana, it can be concluded that housing in Ghana is not affordable. This is hence supported by the research findings of GREDA and Danso that building materials account for the high cost of house prices in Ghana. Therefore, using Madina as a case study, this research focused on finding cost-effective building materials to make housing in Ghana more affordable. It evaluated some housing interventions in foreign countries to find out if these interventions can be used in Ghana and in an area such as Madina. Through

quantitative methods, it would be understood if individuals are interested in exploring some of these building materials in constructing their homes.

Recommendations were made regarding the building materials that would work best in Madina, Ghana to reduce the cost of housing.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The purpose of this study is to identify cost-effective building materials to aid in affordable housing in Ghana. This chapter explains the tools used and research methods implemented to gather and analyse data to achieve the aim of this research. This chapter is made up of four main subsections, which are the following: research design, the scope of the study, data collection process, and data analysis.

3.2 Research design

A research design is a plan that guides a study to analyse the research questions applicable to the study (Lavrakas, 2008). Also, the research design accounts for the methods used in the study and how those methods apply to the objectives and research questions (Jupp, 2011). The study will use the quantitative method approach to analyse data gathered statistically. The quantitative method investigates a phenomenon using empirical data through mathematical equations and statistics, to mention but a few (Given, 2008). The quantitative method focuses on gathering data and generalising it to a population, or it can be used to explain a phenomenon. In this case, the quantitative method would be used to explain homeowners' preference for certain building materials and whether they will be receptive to other building materials.

3.3 Scope of Study

3.3.1 Sample size

According to the Ghana Statistical Service (2012), the 2010 Population Housing Census revealed that there were about 3,392,745 million stock of houses in Ghana with 40.8% of private individuals owning them, while 31.1% of the housing stock was rented out. However, with time being a constraining factor, the research will focus on Madina as a case study. Therefore, the population available to this research is the number of households in Madina which is 28,270 households with a population of 108,05,1? according to the 2010 Population Housing Census.

To calculate the sample size for this research, the Taro Yamane formula (1974) was used.

This is, $n = \frac{N}{1+N(e)^2}$ where;

n is the sample size to be derived

N is the population

e is the margin of error

$$n = \frac{28,270}{1+28,270*(0.05)^2} = 300.$$

The defined sample size for this research is 300 participants who live in Madina.

About 37% of the participants were house owners and 29% were tenants. This information is further discussed in the Findings section of this thesis.

3.4 Sampling Strategy

For this research, simple random sampling was found to be more appropriate to obtain the data needed. As explained by Maheshwari (2017), simple random sampling is a type of probability sampling method that involves selecting a unit and everyone in the population has an equal chance of being chosen. Yates, Moore, and Starnes (2008) describe simple random sampling as choosing a subset from a larger group, and it can be free of classification error.

Due to privacy and security issues, it was near impossible to obtain information on the details of inhabitants living in Madina. Therefore, although the simple random sampling would have been the best option for this study, it could not be used. Therefore, the research used quota sampling instead.

Unfortunately, due to the time limit on this research, quota sampling was deemed more appropriate. Also, since the sampling frame could not be easily derived and there was a small budget allocated to this research, quota sampling was a better option. Quota sampling can be defined as a non-probability sampling method of gathering representative data from a group (Saunders, Lewis & Thornhill, 2012).

Close-ended surveys and questionnaires were administered to the participants. A sampling frame was not derived for this research, therefore visiting the homes of people and some participants at workplaces helped in finding respondents. Also, individuals who were not acquainted with the English language had the questionnaires translated for them. The objectives of the questionnaire were to ascertain if individuals would be interested in purchasing a homemade with alternative building materials. The questionnaire could be answered in less than 10 minutes. Close-ended surveys provide participants with a limited number of options to choose from. With close-ended surveys, the answer choices should be both

exhaustive and mutually exclusive (Lavrakas, 2008). This means that the answer choices should not overlap with each other, and all answers are provided for.

3.5 Data Collection Procedure

The main objective of this study was to first outline the building materials that would be suitable for construction in Ghana and also note whether Ghanaians living in Madina would be interested in purchasing these cost-effective building materials.

The three main building alternatives that were recommended to be constructed in Ghana are plastic bricks, shipping containers, and pre-fabricated materials. Based on these three building materials, participants answered which of the three they would prefer to have a house constructed out of. Within a period of about two to three weeks, questionnaires were handed to inhabitants of Madina.

3.6 Data Analysis

For this research, quantitative analysis was adopted to analyse the data that were collected. The quantitative analysis was considered appropriate to analyse the data because quantitative analysis involves the use of close-ended surveys which would assist in interpreting findings statistically and with numbers. Also, the data were analysed using Microsoft Excel.

3.7 Ethical Considerations

This research was conducted ethically by ensuring the confidentiality of participants' identity and truthfully reporting the findings. Participants responded to the questionnaire on their own accord. They were sufficiently informed about the objective of the research. Incentives were not given out to participants when they

responded to the questions in the survey. They were, however, made aware that they were contributing to a body of knowledge on housing in Ghana.

3.8 Limitations of the study

The drawback that this research faced was that some of the participants had expectations of how houses may have to look. Therefore, this required further explanations of these building materials, especially since some of the participants were not familiar with some of the housing alternatives. This included the use of pictures to help participants have a better understanding of the housing alternatives. A limitation of the study was the time constraint and inadequate exploration of other building alternatives; the study recommended just three alternative building materials. The three main cost-effective building materials were recommended because they have proved to be more popular and efficient in other countries.

3.9 Conclusion

This chapter explored the use of quantitative methods and quota sampling to gather data for the research topic. Questionnaires were administered to the sample size that was determined. The collected data was analysed using quantitative means with the help of Excel. The quantitative method and the quota sampling technique aided in gathering information that contributed to understanding the views of citizens on using alternative building materials to construct homes.

CHAPTER 4: RESULTS

4.1 Introduction

This section presents the findings of the research conducted. The research sought to find out if those living in Madina would be interested in using cost-effective building materials. The chapter acts as a bridge between the findings gathered through questionnaires and existing literature.

The findings are categorized into two segments. The first segment gives the breakdown of general research. It provides details on the demographics and household income of the participants. The second part of this chapter provides an analysis of the data obtained. It includes information on whether participants were truly interested in cost-effective building materials.

4.2 Demographics

Madina, a suburb in Accra, Ghana was chosen as the main focus of this research. A sample size of 300 individuals was identified to be appropriate for this research. The questionnaires were filled by 302 inhabitants of Madina, however, there were two incomplete questionnaires; therefore, 300 questionnaires were filled and contributed massively to this research.

All participants involved in this research agreed to answer the questions to the best of their knowledge and capabilities. All participants were Ghanaians and were inhabitants of Madina. Also, participants were between the ages of 21 and 60 years.

Inferring from Table 2, more males were interviewed as opposed to females. Furthermore, the majority of the respondents found themselves in the unskilled sector.

Table 2

Employment of Participants

Type of Job	Percentage of Respondents
Unskilled Workers	37.79%
White-collar jobs	29.10%
Skilled Workers	20.4%
Full-Time Students	7.02%
Other	5.69%

4.3 Household Income

To understand if Ghanaians could afford a home, it was important to consider their household income with the cost of the home also. From the median multiple introduced in Chapter 2, it was noted that the vast majority of Ghanaians do not earn enough income to afford a home. Therefore, to contribute to this knowledge, participants were asked questions about their household income. Table 3 provides the idea that more than 75% of respondents earn 3,000 cedis or less per month.

Table 3

Household Income

Estimated Monthly Household Income	Percentage
Up to 3,000 cedis per month	75.25%
Between 3,000 to GHS 5,000 cedis per month	20.74%
Between 5,000 to 10,000 cedis per month	3.01%
Between 10,000 to 20,000 cedis per month	0.67%
Above 20,000 cedis per month	0.33%
Total	100%

From this information, it is perceived that the majority of the inhabitants in Madina may not earn enough money every month, to enable them to own a home. This information supports the median multiple derived, which highlights some working Ghanaians' inability to afford a home.

4.4 Ownership of Homes

To further understand the behaviour of individuals towards cost-effective homes, the ownership of homes was taken into consideration. The table below summarises the responses of participants on whether they own homes or not. From the table, it can be noted that a majority of individuals rent instead of buying or building homes. However, the majority of individuals who admitted to renting or occupying a residence as a caretaker, stated that they would wish to build or buy a home in the next 5 years at the very least. This provides some details to the knowledge that some Ghanaians would genuinely prefer to own a house instead of regularly paying rent.

Table 4

The Percentage of Participants and their Ownership of Property

Ownership of Property	Percentage
I am / we are renting	37.12%
I/we built it myself/ourselves	29.77%
I/we bought it from someone or an organisation	17.73%
I am occupying it as a caretaker (not paying)	15.38%
Total	100%

Furthermore, the graph below further breaks down how much the respondents who either bought or built home had to spend on doing so. More than 38% of the respondents spent between 500,000 to a million cedis to acquire a home for themselves. One may agree that it costs a lot to either buy or build a home. It may also be for this expensive nature of building or buying that a majority of people tend more to rent homes than build. About 15% of respondents who rent disclosed that housing in Ghana was indeed expensive, but they are hopeful that they would be able to either buy or build a house in the future.

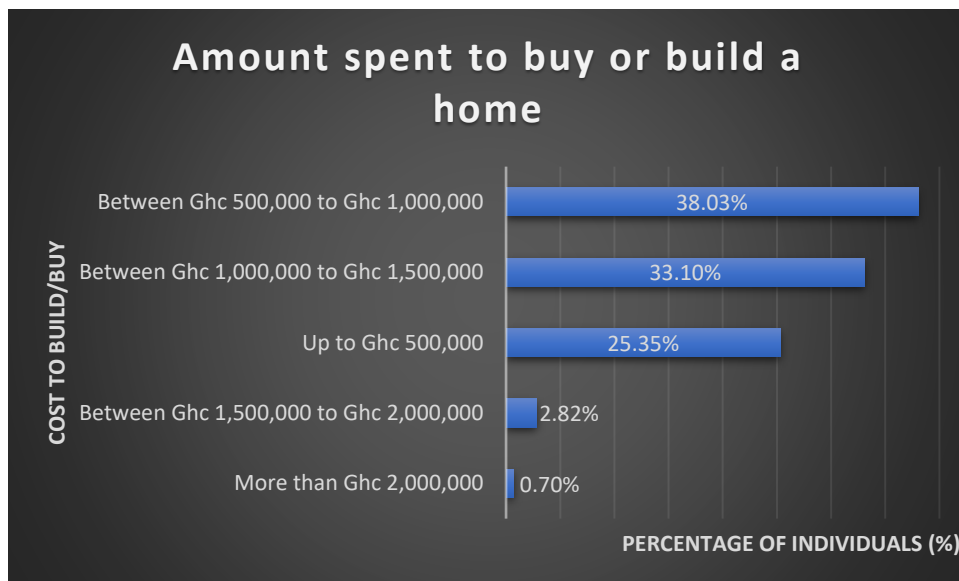


Figure 5: Amount spent to buy or build a home (47.5% of respondents either bought or built a home)

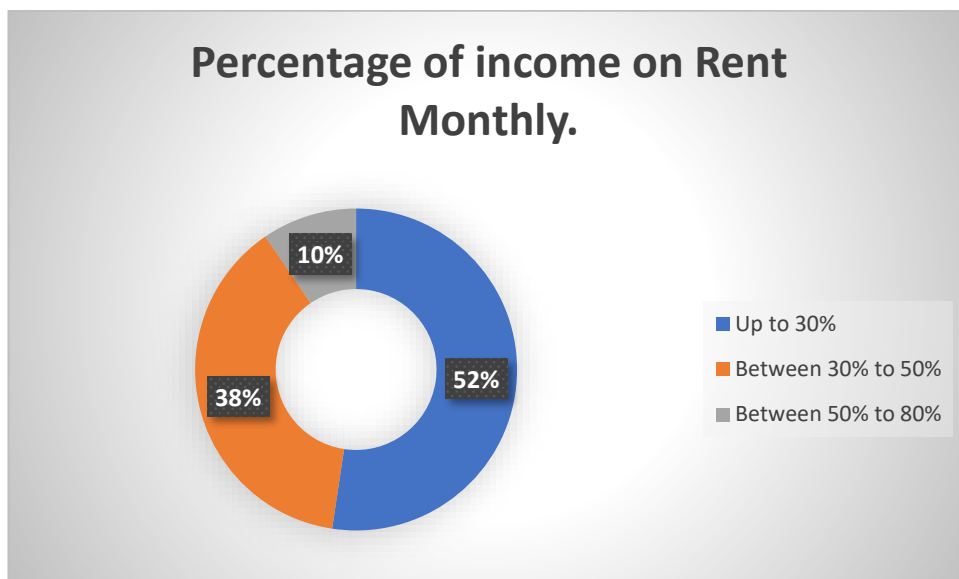


Figure 6: Percentage of Income on Rent Monthly (monthly)

Figure 6 illustrates that more than 50% of respondents spend up to 30% of their income on rent. Further analysis of this supports Konadu-Agyemang's (2008) argument, that individuals who live in Ghana or developing countries, may spend more than 28% of their income on rent, which is not supposed to be so.

Also, respondents made known amounts they spent on their utilities such as electricity, water, waste collection, and security. Below are the graphs representing each utility. The graphs are easy to interpret, with more than 60% of respondents spending up to 200 cedis of their monthly income on electricity. However, more than 80% of participants do not subscribe to using an extra medium of security for their homes such as having security personnel to guard their homes.

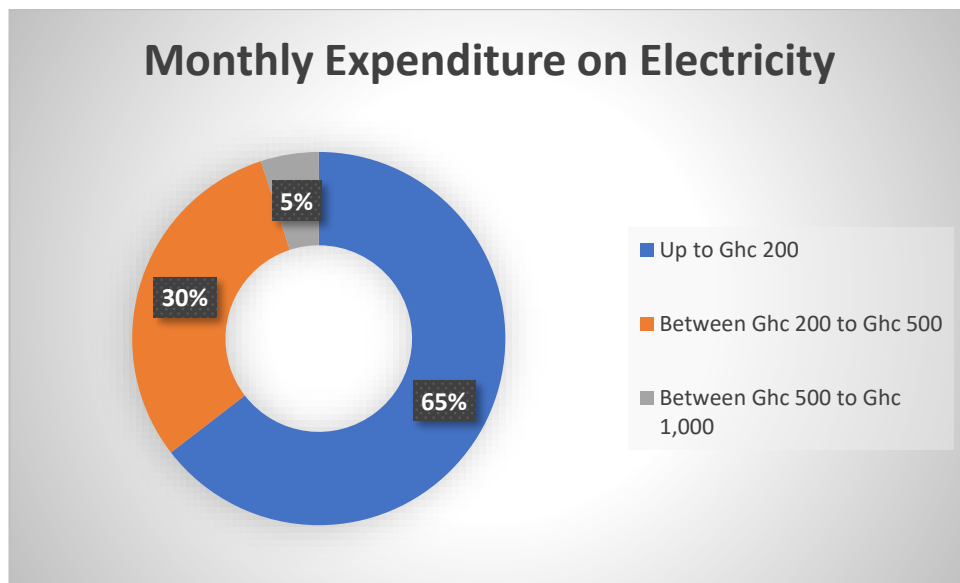


Figure 7: Expenditure on Electricity

With electricity, about 65% of participants disclosed that they spend up to GHS 200 on electricity monthly, while 30% spend between GHS 200 to GHS 500 and 5% spend above GHS 500 on electricity every month.

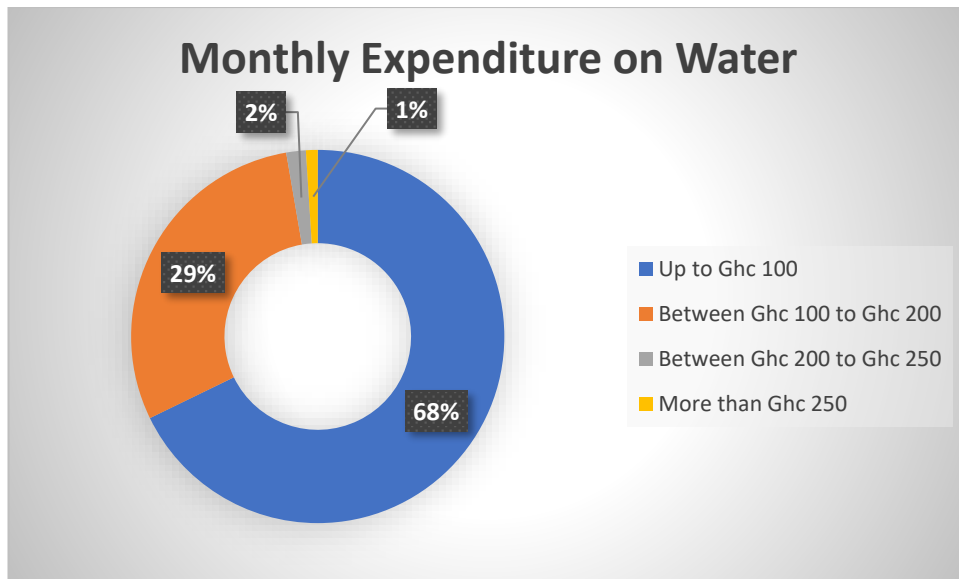


Figure 8: Expenditure on Water

Furthermore, a majority of about 68% of participants revealed that they spend up to GHS 100 a month on their water consumption. 29% of respondents disclosed that they spend between GHS 100 to GHS 200 on the water every month, while 2% and 1% of participants spend between GHS 200 to GHS 250 and more than GHS 250 respectively on the water every month.

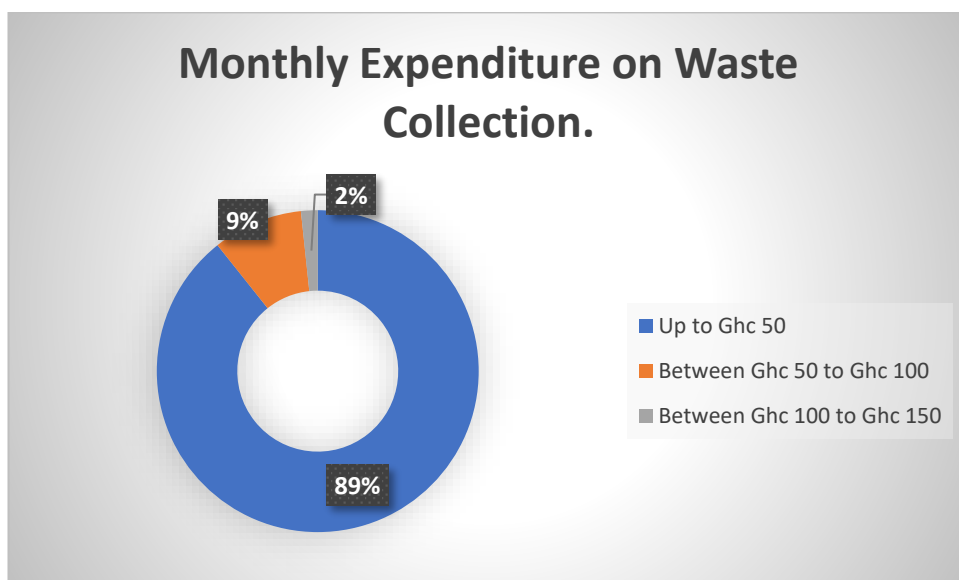


Figure 9: Data Collection on Expenditure on Waste

As far as expenditure on waste is concerned, it can be seen that almost 90% of respondents do not spend more than GHS 50 on waste, whilst less than 10 % of respondents spend more than GHS 50 on waste collection every month. Comparing this data on waste collection to the other utilities, it can be said that respondents spend less on waste than any other utility.

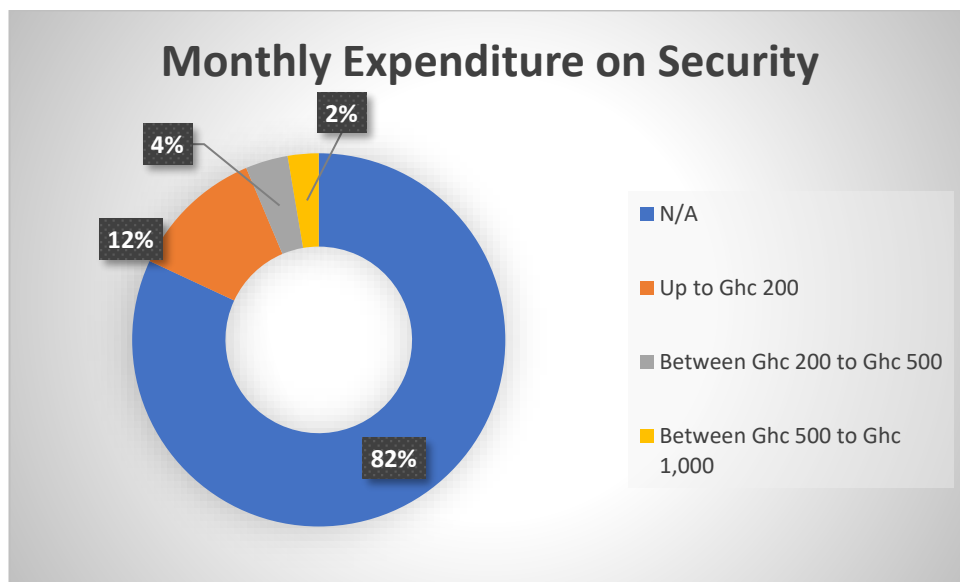


Figure 10: Data Collection on Expenditure on Security

From the data analysed, more than 80% of participants do not subscribe to any form of extra security measures. However, more than 10% of respondents spend less than GHS 200 on security whilst 4% and 2% of respondents may spend up to GHS 500 and almost GHS 1,000 on security every month.

4.4 Materials

Participants responded to questions on which of the three-building materials they would prefer to use. About 70% of respondents preferred the use of prefabricated materials to plastic bricks and shipping containers. Although no assumptions were made to determine which materials participants would be interested in, it was expected that majority would choose shipping containers. This is because companies such as Ghana Container Building construct homes out of shipping containers. Also, the idea of shipping containers solving the housing deficit in Ghana has become popular (Dzodzomenyo, 2019). Moreover, with the aid of pictures, the functions, and importance of these materials were explained to participants to enable them to gain a clearer view of each building material.

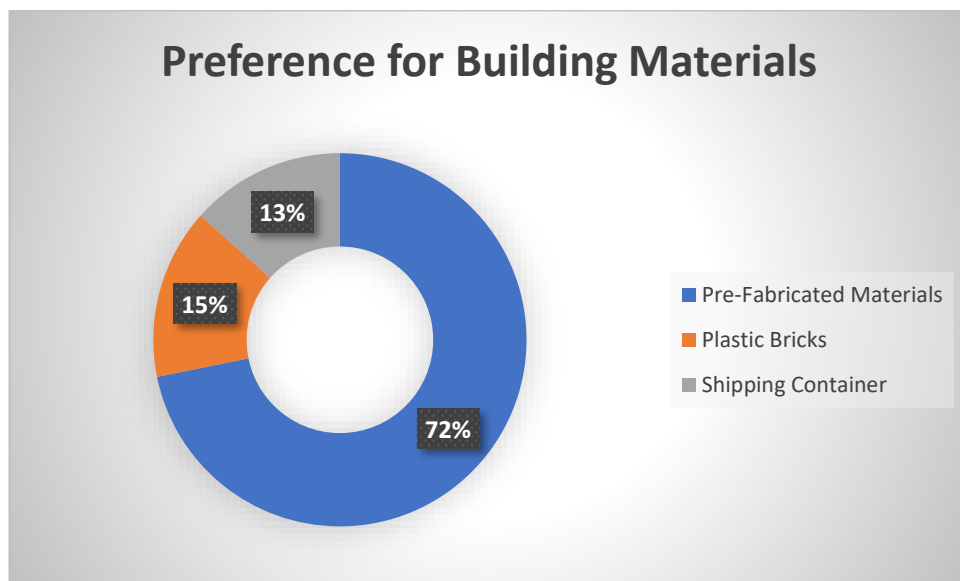


Figure 11: Preference for Building Materials

From the questionnaire, a question was asked about if respondents would prefer their homes to make out of other materials aside from the three main ones discussed. Although they did not state what percentage of the materials they would

prefer their homes to made out of, 89 participants out of 300 respondents stated that they would prefer their homes to be made out of the following building resources:

1. Wood
2. Clay
3. Styrofoam
4. Red Bricks
5. Metal
6. Mud

4.5 Analysis

This study aimed to answer the research question, “what alternative building materials can be applied in Ghana?” The research also identified three alternate building materials that can be considered in Ghana. The study went further on to interview individuals who live in Madina to understand if they’ll be interested in these building materials. About 71% of the participants preferred pre-fabricated materials to shipping containers and plastic bricks. About 70% of these individuals preferred the pre-fabricated materials because they believed that it had a better aesthetic design compared to the other two. The relative cost of the pre-fabricated material was not stated in comparison to the shipping container and the plastic bricks. The respondents believed that were all equally less expensive than the traditional method of constructing homes. Further discussion with some participants revealed that the perception of how shipping containers are viewed in Ghana may have influenced their choice. Some stated that shipping containers are usually used

as shops, therefore they would prefer the prefabricated material as it looks more like a regular house

From the data gathered, respondents revealed that they selected the pre-fabricated materials because it also had a better aesthetic appeal as compared to the shipping container and plastic bricks.

In the literature review of this paper, Konadu-Agyemang (2012), argues that Ghanaians are unable to afford homes due to the costly nature of acquiring one. A further discussion with some of the participants confirmed this argument. Some of the participants revealed that it was quite expensive to obtain a home in Ghana. One respondent stated that although he has struggled in acquiring land and the materials to build a home, he would love to own a house one day. Another lady disclosed that although she has plans of buying a home, she would prefer to rent in this period since it is less costly for her. The data collected revealed that more than 37% of the participants rent homes. It can be gathered from Konadu-Agyemang's argument and some of the participants' statements, one of the reasons majority prefer to rent a home is because it is less expensive, although they do have hopes of owning a house.

Furthermore, the Affordability Index Section in chapter 2 of this study, supports the above argument. The median multiple derived indicated that housing in Ghana was severely unaffordable.

The above analysis contributes to the idea that there is a relationship between one's household income and the ownership of property. The data gathered revealed that the majority of individuals rent a house, informing also that majority earn up to 3,000 cedis. This relationship between the amount a person earns may influence a person's decision to either rent or own a home. It can be analysed that since a person

may be earning up to 3,000 cedis, it would cause him or her to rent a home since it may be less expensive.

Inferring from Chapter 2 of this thesis, the cost-effective building materials mentioned above can be applied in a tropical zone like Ghana. The data gathered revealed that more than 70% of respondents residing in Madina would desire to live in a pre-fabricated home. This research answers the research question which affirms that individuals are interested in cost-effective building homes, but the majority are geared towards pre-fabricated homes. The data gathered also affirmed the argument raised in the literature review by Konadu-Agyemang (2008).

CHAPTER FIVE: CONCLUSION

5.1 Introduction

This chapter provides a summary of the research that was undertaken, including information on how the data was gathered and analysed, the findings, and the recommendations made. Also, the concluding chapter provides recommendations for further studies to researchers who may be interested in this area of research.

5.2 Summary of Study

Housing was identified as an essential need for everybody. However, with the current housing deficit that Ghana faces, it was evident that not every individual has the opportunity to have good access to an affordable home. This research thought through possible ways that the country can reduce its housing deficit. A look at the literature review revealed that the use of cost-effective building materials is a sector that has not been thoroughly explored. The literature review suggested that cost-effective building materials can be investigated to contribute to the reduction of the housing deficit in Ghana. Therefore, this research sought to probe into inexpensive building materials that can be used for building construction in Ghana.

The literature review revealed that one of the main factors of the high cost of houses in Ghana is the increasing cost of building materials. Therefore, Addo (2014) suggested that research should be conducted to determine cost-effective building materials that can help reduce the overall cost of building a house. Also, the median multiple derived indicated that housing in Ghana is expensive. Cost-effective building materials that have been applied to other countries were identified and it was indicated that these building materials can be applied in Ghana.

To determine whether individuals will be interested in these building materials or not, the quantitative method and random sampling approach were employed to derive the sample size. The sample size that was derived using the Taro Yamane formula was 305 respondents comprising house owners and tenants in Madina. Questionnaires were handed to the inhabitants of Madina.

Data was collected and analysed using excel. The findings from the research showed that inhabitants of Madina are interested in the recommended alternate building materials. However, the majority of the respondents (70%) prefer pre-fabricated materials to shipping containers and plastic bricks.

5.3 Recommendation

The information above in this chapter demonstrate that when homes are built out of prefabricated materials, they would be purchased. However, other than the other two cost-effective building materials (shipping container and plastic bricks), other alternative building materials can be explored to aid in a general reduction in the cost of building homes.

Also, real estate developers interested in constructing cost-effective homes must take note of the aesthetics of the building and develop durable homes that would be pleasing to the eye, however at a low cost. Although pre-fabricated materials may have a general appealing look, it is still inexpensive. Therefore, real estate developers should take note of developing cost-effective homes that have an attractive finish.

Last but not least, this research provides a surface look at cost-effective building materials and if they can be applied in Ghana. Future researchers can

provide an in-depth look at other cost-effective building materials at the national level. (isn't the next section about future research?)

5.4 Recommendations for Further Research

It can be noted that in subsequent years, individuals would be searching for other means to reduce the cost of homes in Ghana (Dzodzomenyo, 2019). It is, therefore, necessary that the area of alternative housing can be explored further. Due to the time limit and resource constraint on this study, extensive research can be undertaken to find out if Ghanaians would be interested in these alternate building materials. Also, research can be conducted on other alternative building materials, aside from the shipping container, plastic bricks, and prefabricated materials, that can aid in affordable housing in Ghana. Future research would provide information on whether these building materials can reduce the cost of housing and the housing deficit in Ghana overall.

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