Ashesi University College

Investigating the Economic Benefits of Sustainability in Commercial Real Estate Developments

By

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DECLARATION

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: .....

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I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by Ashesi University College.

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ABSTRACT

The main purpose of this research was to identify the economic benefits of considering sustainability in the building of commercial real estate developments and tackle the problem of real estate development partners implementing westerns ways of building in a blinkard fashion, ignoring the building requirements of the city of Accra given its humidity and tropical characteristics.

The research was conducted by administering of questionnaires to property managers or owners of selected commercial real estate developments in parts of Accra. These individuals that made up the sample size were shortlisted through the use of the snowballing tactic, where an initial point of contact, in this case an architectural firm, would suggest specific stakeholders be approached since they had information relevant to the research.

After conducting a life cycle cost analysis of these selected commercial real estate developments, it was concluded that developments that factored in sustainability and built in accordance with the building requirements given the tropical region did enjoy some economic benefits when compared to developments that did not factor in sustainability.

This research serves as a guide to relevant development partners are now they have contextualised research that proves the economic benefits sustainability can bring when considered.

Table of Contents

List of Figures

List of Tables

CHAPTER 1: INTRODUCTION

1.0 Introduction

Buildings are an essential component of all human settlements and are the focal point for all human endeavours for qualitative living. Mouzughi, et al. (2014) defined real estate as the economy's stock of buildings, the land on which they are built, and all vacant land. They went on to state that these real estate buildings are used either by firms, government, non-profit organisations and so on, as workplaces, or by households as places of residence. Real estate makes up the largest single component of a nation's tangible assets and as such has a significant bearing on the economy and development of a country (Mouzughi et al., 2014). This study discusses the concept of sustainability in commercial real estate by investigating the economic benefits of sustainable buildings.

1.1 Background

Clough et al. (2006) defined sustainability as a process that helps create a vibrant economy and a high quality of life while respecting the need to sustain natural resources and protect the environment. It expressed the principle that future generations should live in a world that the present generation has enjoyed but not diminished.

As discussed by the U.S. Department of Energy (2003), sustainability has three (3) main components – economic prosperity, social responsibility, and environmental stewardship. The environmental fold of sustainability involves taking care of our surroundings – picking up litter, reducing pollution, wildlife and rainforest conservation. The social element involves using open and transparent processes that actively engage relevant stakeholders and

preserving the livelihood of residents, guaranteeing reliable energy supply that supports the local society and the economy (Scott, 2013). Figure 1 below shows the implication of the overlapping of the three components of sustainability.

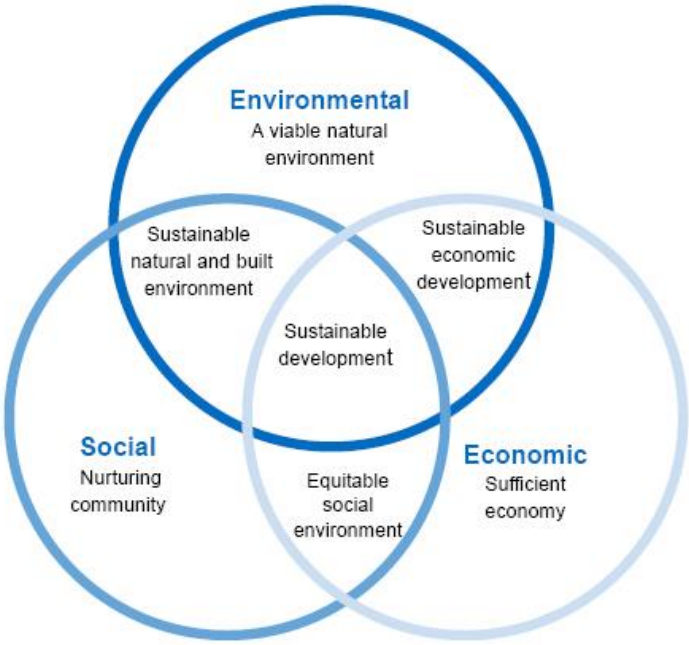

Figure 1: Rings of Sustainability

Source: Pittsburg State University

The Brundtland Commission defined sustainable development as development that meets the needs of the present without compromising the ability of the future generations to meet their needs (Brundtland, 1987). The concept aimed to maintain economic advancements while protecting the unmeasurable value of the environment in which we lived.

The overall goal of sustainable development as such is the long-term stability of the environment and economy. This goal, Emas (2015) stated was only achievable through the integration and acknowledgement of the economic, environmental, and social concerns through the decision-making process. At the core of the key principle of sustainable

development is the decision-making factor, a decision-making process that moves the principles towards development that is truly sustainable.

Due to globalisation, modern lifestyles are being imitated all over the world in various countries, some of which do not consider the vast differences in climate due to its geographical location. An example would be Ghana. Ghana has seen herself welcome globalisation and as such has been exposed to some changes.

1.2 Problem Statement

Ghana's climate is one dominated by warmth and humidity, constantly bringing forth hot conditions and an uninterrupted dampness. With globalisation's influence, buildings in Ghana are being renovated with stakeholders in the construction industry following the trend of having real estate developments copy the modern building lifestyles of the developed world.

Recognising this, there is a need for sound decisions when thinking through the typical building requirements for commercial real estate developments in these humid regions.

A visit to the one green certified building in Ghana, One Airport Square, while visiting other non-certified and indeed sustainable buildings showed that there is a generally higher level of satisfaction in the environment created by the sustainable buildings by the people working in it. According to Archdaily (2015), One Airport Square is the first building in Ghana to have been awarded 4-Stars (Design Stage) by the Green Building Council of South Africa (GBCSA).

According to Yudelson (2008) and Kibert (2008), it costs more to construct green buildings as compared with conventional buildings as green materials cost significantly more than ordinary materials. The fear of higher investment costs for sustainable buildings compared

with non-sustainable buildings and the risks of unforeseen costs are often addressed as barriers for sustainable buildings.

At that moment, the passion to investigate the benefits one enjoys from sustainable buildings was awoken to disprove this barrier and to make a case for the long-term economic benefits of sustainable buildings despite the initial high costs.

1.3 Research Questions

- How have commercial real estate buildings incorporated sustainability in their construction?
- Are there economic benefits to be enjoyed from incorporating sustainability in commercial real estate?

1.4 Main Objective

- To investigate the economic benefits of factoring sustainability in the building of commercial real estate buildings in parts of Accra.

1.4.1 Specific Objectives

1. Define what economic sustainability is.
2. Determine the life cycle cost of selected sustainable and non-sustainable commercial real estate.
3. Determine the economic benefits of sustainability.
4. Make recommendations to real estate developers regarding the adoption of sustainability in construction.

1.5 Research Method

The Kinnear and Taylor's (1996) research approach was used in gaining relevant information and insight from the data collection process. This approach included determining the research design, developing the data collection process, designing of the sample, collection of data, processing of the collected data, analysing of the collected data, and presenting the results of the research.

In collecting data, qualitative methods of data collection were employed. The data was analysed through the computation of a life cycle cost with a graph representing the computed life cycle cost.

1.6 Justification

This research serves as a guide to inform relevant real estate development partners – clients and property managers of the economic benefits to be enjoyed from factoring sustainability in building.

1.7 Research Relevance

- This research informs real estate development partners of the economic benefits of sustainable building.
- This research helps real estate development partners in making better decisions that will have positive implications on suitability: economic prosperity, environmental stewardship, and social responsibility.

1.8 Thesis Outline

Chapter 1: Introduction

The introductory chapter of this thesis gave an overview of the contents of the academic paper. It outlined the various sections covered by research and introduced the reader to the paper. It also covered the main and specific aims and objectives of the paper.

Chapter 2: Literature Review

This chapter discussed what scholars and credible academics have said about sustainability and the economic benefits of sustainable building. It allowed the researcher to find gaps in written literature and critique unjustified aspects of the literature and attempt to fill the gap.

Chapter 3: Methodology

This chapter discussed the methods the researcher used in gathering data for the academic paper. It looked at the research approach and methods, techniques, as well as some analytical tools used in the data analysis.

Chapter 4: Data Analysis and Discussion

This chapter presented the findings of the research and communicated the findings of the study. The chapter also discussed the findings of the research.

Chapter 5: Summary, Conclusions and Recommendations

This chapter summarised, made recommendations and drew conclusions based on findings from the research methods and literature search.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed existing literature on sustainability and went on to narrow down to the concept of sustainable building, touching on the benefits derived from sustainable buildings. The chapter explored the gap and addressed it concerning the economic benefits derived from going the sustainable way with commercial real estate developments in Accra, Ghana.

2.2 Climatic Zones and Typical Building Requirements

According to Oppong and Badu (2012), Ghana is geographically divided into three main climatic zones: the warm-humid (e.g. Kumasi), the hot-dry (e.g. Tamale) and the coastal-hot savannah climatic zones (e.g. Accra). The Greater Accra regions constitute the coastal-hot savannah climatic zone. Building materials and construction technology generally differ from one climatic zone to another in Ghana. Figure 2 serves as a representation of the tropical zones of Ghana (Oppong and Badu, 2012).

Figure 2: Ghana Climate Map

Source: Oppong, R. A., & Badu, E. (2012).

Figure 3: Vernacular House

Source: Pinterest

North-East India, like Ghana, is classified into three climatic zones (warm and humid, cool and humid and cold and cloudy) and vernacular houses in each climatic zone possess distinct climatic responsive features (Singh et al., 2007). Figure 3 and Figure 4 are representations of a typical vernacular house.

Figure 4: Modern Vernacular Home

Source: Home Adore

The most prominent features of the hot-dry climates are very hot, dry air and dry ground. Day-time temperatures normally range between 27 and 49°C with humidity constantly ranging from moderate to low (Koenigsberger et al., 1974). Outdoor conditions are so hostile in the hot-dry climate, that building interiors and exteriors are protected from solar radiation and the hot, dusty winds. Walls and roofs are constructed with heavy materials with large thermal capacity to absorb much of the heat entering through the outer surface of the wall during the day (Koenigsberger et al., 1974). On the other hand, the warm-humid climate is characterised by hot, sweaty and sticky conditions as well as the continual presence of dampness. Air temperatures remain moderately high, between 21 and 32°C, with little variation between day and night (Koenigsberger et al., 1974).

2.2.1 Typical Building Requirements for Humid Regions

Ampadu-Asiamah and Gyebi-Adjei (2014) defined sustainable construction as the provision of built developments that are efficient and affordable, socially acceptable and less damaging

to the environment. According to Ampadu-Asiamah and Gyebi-Adjei (2014), some sustainability requirements relating to the design and construction of the building envelope included the fact that:

- It is essential to consider the local climatic conditions (temperature, moisture, wind) in order to know the materials for construction of the building envelope.
- The potential for natural ventilation in the context of an overall climate control strategy must be exploited while minimising energy use and maximising comfort.

Ampadu-Asiamah and Gyebi-Adjei (2014) wrote about the importance of climatic forces in buildings. They hampered on the problem that lies in the fact that buildings in these tropical regions are imitating those in the temperate regions regardless of the applicability of these changes and its effect on sustainability. The requirements for buildings built in the climatic region have been discussed at length by various writers with all of them in agreement that buildings in such regions are supposed to provide comfort, be functional, and environmentally friendly or sustainable (Ampadu-Asiamah & Gyebi-Adjei, 2014). According to Koenisberger et al. (1980), buildings should be opened up to breezes and orientated so as to catch available air movement to facilitate the removal of heat from into the external environment. Shading devices were also suggested to reduce radiation from the sky. Natural, mechanical, and night forms of ventilation; free and artificial cooling; light weight construction; daylighting and either solar shading or control are a number of considerations for buildings in the tropics considered important (Lloyd, 1998). Bay and Ong (2007) write that shading devices that incorporate sun breaks, verandas, and appropriate openings tend to be more efficient given the humidity of the region.

In order to better appreciate and understand architectural happenings in Ghana, sight must not be lost of the contextual circumstances within the overall macroeconomic conditions and the enhanced economic circumstances besides the prevailing building material and architectural practices as well as the ongoing process of urbanisation in the world. Ghana is now rapidly urbanising as in many African countries.

Two main materials noted for outer wall construction are mud bricks, sometimes called earth; and cement, also known as concrete. Another material gradually gaining popularity but not captured in the Ghana Statistical Services (2005) database is glass.

The most common materials used for building walls in the warm-humid regions are stones and earth-based bricks. Sand-cement blocks are extensively used in the warm-humid regions in Ghana because they appeared relatively cheap and satisfactory to use as building material. Traditionally, earth-walled courtyard houses are typical with broad overhanging eaves to shade the exterior walls. Pitched roofs covered with various corrugated metallic sheets are common in the warm-humid climates in Ghana.

Oppong and Badu (2012) concluded that buildings materials used in the warm-humid and hot-dry climates in Ghana disregard statutory regulations of architectural values and general standard of development of any particular neighbourhood.

2.3 Sustainability

Clough, Chameau, and Carmichael (2006) referred to sustainability as the process that helps create a vibrant economy and a high quality of life, while respecting the need to sustain natural resources and protect the environment. It expressed the principle that future

generations should live in a world that the present generation has enjoyed but not diminished. Jucker (2003) pointed out that sustainability is achieved when all people on Earth can live well without compromising the quality of life for the future generations.

The U.S. Department of Energy (2003) wrote that sustainability has three goals or "cornerstones":

- Environmental stewardship: protecting air, water, land, and ecosystems, as well as conserving resources, including fossil fuels, thus preserving the earth's resources for future generations.
- Social responsibility: improving the quality of life and equity for individuals, communities, and society as a whole.
- Economic prosperity: reducing costs, adding value, and creating economic opportunity for individuals, organisations, communities, and nations.

According to the U.S. Department of Energy (2003), questions were being asked about sustainable design. These questions usually took the form of: What does it cost? What are the benefits? The author goes on to use the "triple bottom line" benefits framework and applies it to sustainable building design and construction. Figure 5 is used by the author to try and describe the benefits and further answer the typical questions that arise with the talk of sustainable design.

U.S. Department of Energy (2003) documented the three categories of the benefits – economic prosperity, social responsibility, and environmental stewardship– derived from sustainability.

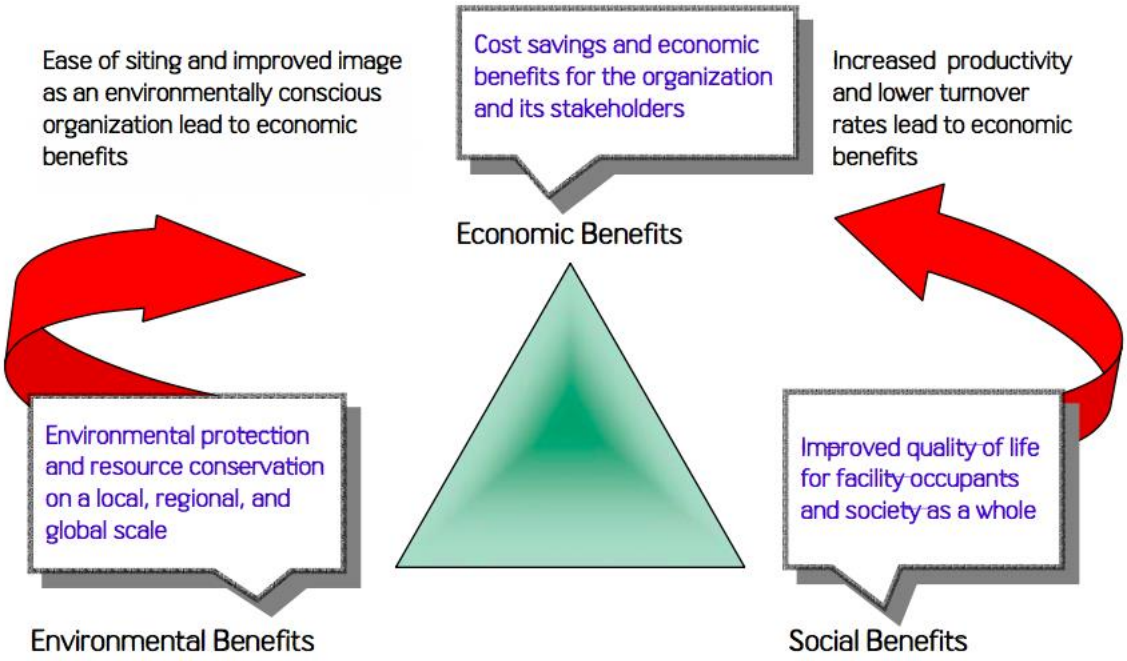

Figure 5: "Triple Bottom Line" Benefits of Sustainable Design

Source: (U.S. Department of Energy, 2003)

The figure above indicates environmental and social benefits can lead to economic benefits for the owners of these buildings. They point out that the economic benefits to the building owner include initial cost and operating-cost savings. Principal social benefits of sustainable design include improved health, satisfaction, and well-being of building occupants, the U.S. Department of Energy (2003) writes. The author also hammered on the benefits to the environment stating that the environmental benefits from lower amounts of fossil fuels, less air pollution and greenhouse gas emissions, reduced consumption of water and other natural resources, and reduced use of virgin building materials. With the review of literature about sustainability in general, ignoring sustainable buildings is an oversight that cannot be justified.

2.4 Sustainable Buildings

The World Commission on Environment and Development stated that sustainable development meets the needs of the present without compromising the ability of future generations to meet their needs (Benson, 2004). According to Glavinich (2008), the term green building is defined in the American Society of Testing and Materials (ASTM) Standard E2114-06a as a building that provides the specified building performance requirements while minimizing disturbance to and improving the functioning of local, regional and global ecosystems both during and after its construction and specified service life.

Despite having multiple definitions, a green building essentially means a building that is energy and resource efficient and has minimal disruptions to the environment. Green building is often mentioned together with sustainable construction, and sometimes these two terms are used interchangeably. According to Kibert (2008), sustainable construction focuses on the ecological, social and economic issues of a building in the context of its community. Therefore, green building can be a subset of sustainable construction and is a stepping stone to sustainable development, which has been defined as being able to meet present needs without the expense of the needs of future generations (CIRIA C571, 2001).

Green buildings are constructed based on the principles of sustainable construction, which addresses the ecological, social and economic issues of a building in the context of its community. These buildings are designed and built to use less energy and resources than non-sustainable buildings and aim to minimize their impacts on the environment (Yudelson, 2008).

Green buildings form an important part of the generation of sustainable built environments which includes the infrastructure, services, buildings and networks which make up our cities and towns.

According to Hassan et al. (2002) and Kolev (2009), a green building is designed and constructed in a way that is measurably less harmful than non-sustainable buildings to the environment and the occupants. In essence, green buildings attempt to solve measurable problems associated with conventional buildings.

Florez (2010) writes that as more owners seek to develop sustainable buildings, the construction industry is adapting to new requirements to meet owner's concerns. The market for sustainable buildings is increasing since the construction industry has acknowledged they may mitigate the impact on the environment and bring significant economic, financial, social and environmental benefits (Ries et al., 2006; Wang et al., 2005; Thormark, 2006; Muse and Plaut, 2006; Baker 2006). To realize such benefits, it is necessary to select materials which conform to sustainable principles (Abeysundara et al., 2009; Wang et al., 2005; Glavic and Lukman, 2007). Selecting inappropriate materials may impact the performance of the building and preclude the achievement of the desired sustainability goals (Florez, 2010).

2.4.1 The Economic Benefits of Sustainable Design

U.S. Department of Energy (2003) write about the various stakeholders that seek to benefit from the option to use materials that save costs and reap economic benefits. They talk about the use of integrated designs that incorporate sustainable materials reducing initial costs after compared with traditional projects. While other projects have, designs incorporating such materials have higher first costs, the payback period for the incremental investment is often short and the lifestyle cost typically lower than that of more non-sustainable buildings and

projects. They point out that evidence is growing that sustainable buildings provide financial rewards for building owners, operators, and occupants (U.S. Department of Energy, 2003). Sustainable buildings typically have lower annual costs for energy, water, maintenance or repair and other operating expenses. Additionally, buildings of sustainable nature have features that offer owners' economic benefits ranging from longer building lifetimes and increased asset value.

According to the U.S. Department of Energy (2003), with lowering cost of maintenance and repair, the sustainable design aims at increasing durability and ease of maintenance of the structure. They point out that alternatively, durable and long-lasting materials can be used in achieving sustainability as this reduces maintenance and repair costs. Incorporating a lighter roof colour can prolong a roof's lifetime as well as reducing the heat gains and air conditioning costs, the author writes (U.S. Department of Energy, 2003). More benefits are likely to be accrued because of a sustainable facility's environmentally and socially conscious image and positive impacts on the building occupants, the community surrounding the facility, and society. The principles of sustainability lead to a longer building lifetime and better adaptability of the building for future uses that cannot be foreseen. Additionally, investing in sustainable design features can considerably increase the resale value of a property because it lowers annual costs and therefore makes the building more profitable for the new owner (U.S. Department of Energy, 2003).

Researchers in one study argued reduced operating costs are a primary motive for green building. This is corroborated by other studies indicating that companies that pursue green initiatives, such as reducing the energy consumed, are able to reduce energy-related operating costs.

Ala-Juusela et al. (2006) claim that energy-efficient buildings can offer major cost savings during operation. The quantifiable benefits for sustainable buildings could include initial savings, energy savings, maintenance savings, deferred replacement cost, etc. and can be evaluated, measured or calculated using life cycle cost analysis.

Cole and Sterner (2000) and Sterner (2000) address the importance of life-cycle costing (LCC) methods in communicating the economic benefits derived from sustainable building projects.

2.5 Gap in Literature

After much research, it has proven difficult to find information on the implications of the components of sustainability – social responsibility, economic prosperity, and environmental stewardship – for the African context, more importantly the economic benefits of sustainability in the Ghanaian context. This paper seeks to address this gap and state clearly the economic benefits associated with factoring sustainability in the building of commercial real estate buildings.

2.6 Life Cycle Cost Analysis

In addressing the gap, a life cycle cost analysis was done. Life Cycle Costing (LCC) is an important economic analysis used in the selection of alternatives that impact both pending and future costs. It compares initial investment options and identifies the least cost alternatives.

The Pennsylvania State University (2017) writes that there are two reasons to do an LCC analysis:

- To compare different systems

- To determine the most cost-effective system

Additionally, one of two situations may exist:

- The initial cost may be high, but the collective various costs will be low over its lifetime.
- The initial cost of a system and the collective costs may be low, but the useful life of such system may be short (The Pennsylvania State University, 2017).

Therefore, a life-cycle cost (LCC) analysis can be helpful for comparing the total costs incurred over the lifetime of a commercial real estate development. It is, in essence, calculating all the costs incurred to buy, maintain, and run the system over its lifetime. According to Fuller (2016), Life-cycle cost analysis (LCCA) is a method for assessing the total cost of facility ownership. It considers all costs of acquiring, owning, and disposing of a building or building system.

Lowest life-cycle cost (LCC) is the most straightforward and easy-to-interpret measure of economic evaluation (Fuller, 2016).

2.6.1 Costs

Fuller (2016) writes that there are numerous costs associated with acquiring, operating, maintaining, and disposing of a building or building system. Building-related costs usually fall into the following categories:

a. Initial Costs—Purchase, Acquisition, Construction Costs
b. Energy and Water Costs
c. Operation, Maintenance, and Repair Costs
d. Replacement Costs
e. Residual Values—Resale or Salvage Values or Disposal Costs

2.6.2 Basic Formula for Calculating Life-Cycle Cost

The formula for calculating life-cycle cost according to both Fuller (2016) and The Pennsylvania State University (2017) is:

$$\mathbf{LCC = I + Repl - Res + E + W + OM\&R + O}$$

Where, LCC = Total life-cycle cost of a given alternative; I = Initial cost; Repl = Capital replacement costs; Res = PV residual value (resale value, salvage value); L = Desired useful life in years of the building or system; E = Total energy cost; W = Total water costs; OM&R = Total operating, maintenance, and repair costs; O = Total other costs, if any.

Two mutually exclusive outcomes of each commercial real estate development would arise from the computation based on the aforementioned variables, either a positive value or a negative one. A positive value would mean the development has a good life cycle cost while a negative value depicts the development has a bad or poor life cycle cost.

CHAPTER 3: METHODOLOGY

This chapter delved into the research methods used in this academic paper. It also stated the instruments used in the gathering of relevant information. It outlined the strategy employed in research as well as the methods or procedures used in investigating the economic benefits of sustainability in commercial real estate developments.

A research process by Kinnear and Taylor (1997) served as the reporting framework for this study. The process involved determining the research design and sources of data, developing the data collection procedure, designing the sample, determining the type of data, collection and processing of collected data, analysing the data, and finally presenting the results of the research.

3.1 Research Strategy

In research, there are several strategies that can be employed – exploratory, explanatory, and descriptive (Blanche, Durrheim & Painter, 2006). An exploratory strategy seeks to help the researcher acquire more knowledge about the problem to gain an understanding of it (McKenzie & Danforth, 2009). An explanatory strategy comes up with several theories that explain and predict events, explaining the cause and effects between two or more variables (McNabb, 2008). A descriptive research strategy seeks to accurately describe a phenomenon through narrative descriptions (Blanche et al., 2006). For the purpose of this research, an exploratory research strategy was used because it is the best strategy given the need to understand sustainability and its economic benefits. This was done by explaining the life cycle cost difference between sustainable and non-sustainable commercial real estate developments.

3.2 Research Approach

There are two main approaches to conducting research – qualitative research and quantitative research. The two main approaches can however be combined to form a mixed method. The qualitative approach of this mixed method of data collection will provide individual accounts of motivations, behaviours, views and feelings that will be translated into frameworks that illuminate the motivations (Ritchie, 2003). Qualitative research helps the researcher in gaining an in-depth understanding of a problem and phenomenon, hence making the researcher part of the research process (Key, 1997). Qualitative research methods focus on discovering and understanding the experiences, perspectives, and thoughts of participants. This form of research explores meaning, purpose, or reality (Harwell, 2011). VanderStoep and Johnson (2008) write that quantitative research specifies numerical assignment to the phenomena under study. Its primary advantage is that it offers statistical validity, accurately reflecting the population from which the sample was drawn. Quantitative methods distinguish itself from qualitative by being deductive. Deductive approach is a process of reasoning that flows from a theory to a systematic empirical observation (VanderStoep and Johnson, 2008). The research will require qualitative forms of research.

3.3 Research Design

The research took the structure of exploring the case of commercial real estate developments in Accra with architectural firms and developers being the point of contact for gaining access to these developments. This exploratory research threw light on the economic benefits derived from these developments factoring in the concept of sustainability.

3.4 Research Methods

The study used secondary sources of data. Secondary data was retrieved from records and documents of the commercial real estate development, providing the researcher with existing financials associated with the commercial real estate development in question.

The aim was to retrieve relevant financial information to aid in the life cycle cost analysis. The relevant numerical values retrieved were keyed into a formula for calculating the life cycle cost of the selected commercial real estate developments. These selected developments were compared to the only certified green commercial real estate building in Accra, the One Airport Square and other sustainable commercial real estate developments.

3.5 Sampling Strategy

Sampling is important because, in almost all cases, it is not practical to study all the members of a population. There are two ways to select members for a study: non-random sampling and random sampling, sometimes called probabilistic sampling (VanderStoep and Johnson, 2008). A random sample, sometimes called a probabilistic sample, is a sample in which each member of the sampling frame has an equal chance of being selected as a study participant. A non-random sample is a sample in which each member of the sampling frame does not have an equal chance of being selected as a participant in the study (VanderStoep and Johnson, 2008).

VanderStoep and Johnson (2008) write that snowball sampling is a form of non-random sampling. This is an approach that was used to collect data. Under the snowball sampling, a core group of participants is initially sampled. These participants are then asked to identify others who might be eligible to participate. This second generation of participants is then

contacted. These people, in turn, identify other participants. The sample, like a rolling snowball, begins to build on itself and increase in size. The ability to grow a network of participants by taking advantage of your relationship with the current participants is an advantage of snowball sampling. Another related advantage of snowball sampling is that it allows the researcher to focus on people who have particular characteristics of interest to the project (VanderStoep and Johnson, 2008).

The main categories of people the interview will seek to cover are the architect, clients, developers and other development partners. The sample population are individuals in perfect positions to give the researcher access to information about the developments they are associated with. The sample population will also aid in answering the research questions and objectives as they are involved in the development process from inception to management after construction.

3.6 Analysis and Processing of Data

Data retrieved from the administered questionnaires was imputed into a formula to calculate the life cycle cost analysis on the various commercial real estate buildings. The values from the computations of the non-sustainable commercial real estate were compared to that of the sustainable commercial real estate development. Based on the differentiating life cycle cost analysis figures, a conclusion was drawn on whether the sustainable buildings offered some economic benefits, compared to the non-sustainable developments.

3.7 Conclusion

This chapter summarized the methodology used for this study and followed Kinnear and Taylor's (1996) method of gathering information. The next chapter covered the findings derived from an analysis of the data collected.

CHAPTER 4: FINDINGS AND ANALYSIS

This chapter reveals the discussion of the outcome of the results obtained from the study. The data analysis method used in presenting the findings was content analysis.

4.1 One Airport Square

One Airport Square is a world-class development located in Airport City - Accra's newest commercial and retail district. The development is an elegant and contemporary, mixed-use development that comprises of 9 floors of office space, 2,000 m2 of retail space and over 250 car parking spaces.

Figure 6: One Airport Square Building

Source: Archdaily (2015).

Figure 7: Building Section – One Airport Square

Source: Archdaily (2015).

As a pioneer in green design, the development is the first environmentally certified green commercial building in Ghana and is set to become one of the city's prominent landmarks if it has not attained that status already.

Figure 8: One Airport Square

Source: Archdaily (2015).

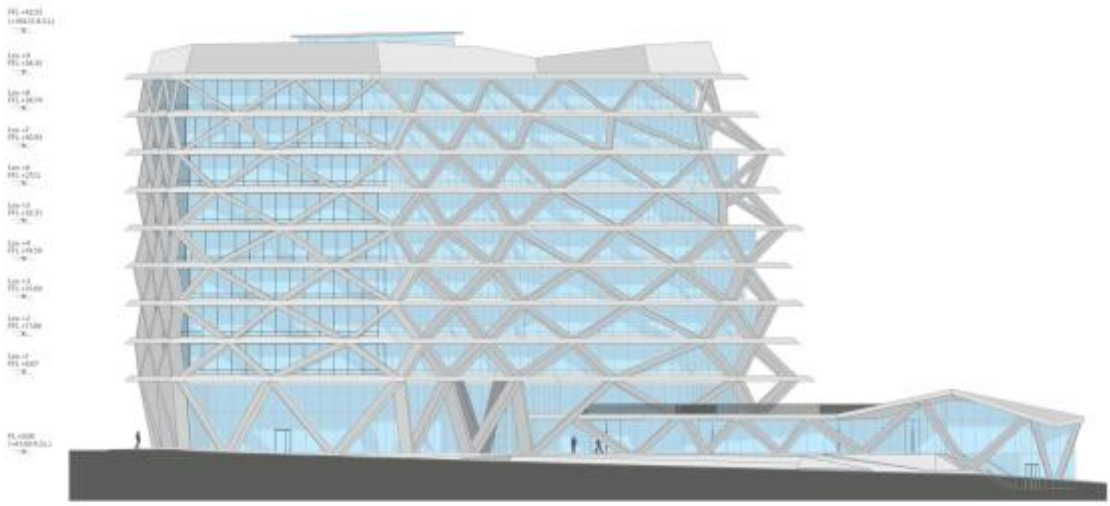

Figure 9: Elevation View – One Airport Square

Source: Archdaily (2015).

The ring-shaped ground floor of the development forms a public plaza suitable for hosting events and exhibitions; and is open to the public on the northeast side of the building (Floornature, 2017).

The building's compact shape conceals an inner atrium promoting natural ventilation and lighting inside. The façade is characterised by two main elements: the inclined pillars of the frame, which improve the building's rigidity while forming a decorative motif, and the patios of different sizes which add interest to the office block (Floornature, 2017).

One Airport Square has obtained 4 Stars (Design Stage) certification from Green Building Council of South Africa as a sustainable building (Archdaily, 2015).

The aesthetic elements of the development, as well as its architectural design which was inspired by the traditional local art and by the from the bark of the palm trees typical of that area, closely linked to environmental strategies provide a viable solution to climate problems (Archdaily, 2015).

Achdaily (2015) states that the development's irregular form reflects the orographic features of the site and has its underground floors configured to consider the typography to the site, presenting technical solutions for structural earthquake resistance. At this latitude, the sun's path makes the project particularly exposed to solar radiation fronts east and west. This, combined with medium to high temperatures present during the entire course of the year, made it necessary to adopt strategies to reduce the need to cool the building (Archdaily, 2015). To reduce consumption of drinking water, there are technologies that limit the amount of outflow, the duration and the time of delivery, while it is expected the reuse of grey water and rainwater for the toilet. eProperty News (2015) states that the development makes maximum use of natural light, the building's façade with overhangs minimise solar exposure which in turn reduces demand on the air-conditioning system. The development also has motion sensors to control the lighting and the harvesting of rainwater for ablutions and irrigation.

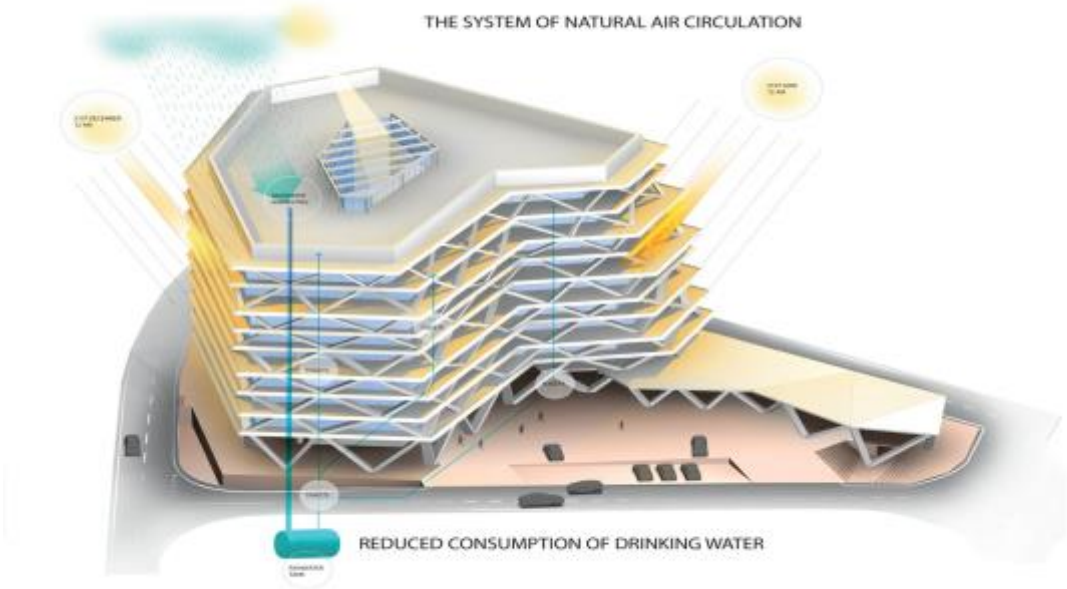

Figure 10: System of Natural Air Circulation – One Airport Square

Source: Archdaily (2015).

With regards to the cooling and heating system of the development, there will be natural ventilation through openable windows that will provide fresh air and meet a percent of the building's cooling demand. During warm months of the year, an underfloor cool air distribution system will meet all requirements for fresh air and cooling (minimum fresh air provision with air recirculation). Whenever necessary, chilled water will be produced by an Air Cooled Chiller located at the roof level. No Heating system provided (UIA, 2011).

Figure 11: Light and Natural Ventilation – One Airport Square

Source: Archdaily (2015).

One Airport Square is a joint venture between Actis and Myma Belo Osagie of Boston Investments Limited, developed by Laurus Development Partners. Politecnica are the structural engineers behind the masterpiece which was designed by the award-winning sustainability architect, Mario Cucinella.

4.1.1 Sustainable Building Features

According to GBCSA (2013), the development has the following features to boost of:

- The building is quite compact in shape, with main elevations facing North and South

- The building has been designed to operate under mixed ventilation mode (natural and mechanical). It benefits from an adequately ventilated atrium at its core
- All the external facades are fully glazed, from floor to ceiling, with openable panels throughout, promoting cross flow natural ventilation whenever feasible
- Horizontal overhanging terraces provide shading to the facades reducing cooling loads and glare risk. According to the orientation and sun position in the sky, the overhang depth has been optimized in order to provide the best combination of solar control and daylight penetration

4.2 Other Commercial Real Estate Developments

A number of commercial real estate development were analysed as part of the sample size in conducting this research. These other developments though from the Greater Accra Region of Ghana were spread across the various cities in the region. Ringway Estates, Airport Residential, Achimota, Abeka-Lapaz, Bush Road (Behind Trade Fair), East Legon, Ashaley Botwe were some of the areas these other commercial real estate developments came from. These commercial real estate developments were discovered by the researcher to be fairly split, with almost half of the developments not going in accordance with the building requirements given the tropical nature of Ghana's location while the other half did. The developments that did not build in accordance with the tropical building requirements failed to capture natural ventilation and resorted to using mechanical ventilation most of the time. Also, they failed to factor in shading devices that boosted cooling in the building, leaving high cooling loads to be met by these mechanical ventilation modes. The other half did build with sustainability in mind and as such spent less on the general operating costs of the

developments as compared to those developments that built without factoring in sustainability.

4.3 Overview of Data

The investigation involved conducting a life cycle cost analysis for selected commercial real estate developments in parts of Accra – Ringway Estates, Airport Residential, Achimota, Abeka-Lapaz, Bush Road (Behind Trade Fair), East Legon, Ashaley Botwe, among others. A total number of 16 respondents participated in the study. These respondents were obtained from snowball sampling, as they were referred to by the researcher's initial point of contact – an architectural firm – who provided the researcher with access to their client list. For confidentiality reasons, neither the architectural firm nor the respondent's true identity will be named. The only respondent to be named is One Airport Square by reason of that commercial real estate being the key development other uncertified green developments will be compared to, with the help of the life cycle cost analysis.

4.3 Data Analysis

A number of questionnaires were administered to clients of an architectural firm in Accra. This was done using the snowballing tactic with the architectural firm being the initial point of contact. The architectural firm subsequently pointed the researcher in the right direction with respects to the relevant real estate development partners to contact for the information needed. As such a number of questionnaires were administered. From the questionnaires administered, a total number of 16 respondents responded, with 11 respondents providing the researcher with all variables necessary for the computation of the life cycle cost – Initial cost; Capital replacement costs; Residual value (resale value, salvage value); Total energy cost;

Total water costs; and Total operating, maintenance, and repair costs. The other respondents restricted access to the necessary figures for various variables of the life cycle cost formula due to confidentiality reasons. Due to the key part each variable played in the formula those projects were taken out of the computation.

Table 1: Life Cycle Cost for Selected Commercial Real Estate Developments in Accra

Project	I	Repl	Res	E	W	OM & R	LCC
1	$235,000.00	$2,482.48	$421,875.00	$7,009.35	$4,654.21	$1,752.34	**-$170,976.64**
2	$81,775.70	$584.11	$93,457.94	$5,841.12	$4,205.61	$7,009.35	**$5,957.94**
3	$275,000.00	$3,103.10	$500,000.00	$8,177.57	$6,425.23	$2,190.42	**-$205,103.68**
4	$200,000.00	$0.00	$320,000.00	$2,336.45	$1,869.16	$467.29	**-$115,327.10**
5	$29,205.61	$10,000.00	$46,728.97	$4,205.61	$1,401.87	$5,841.12	**$3,925.23**
6	$35,046.73	$2,336.45	$35,046.73	$2,242.99	$1,121.50	$3,504.67	**$9,205.61**
7	$46,728.97	$9,345.79	$98,130.84	$6,571.26	$3,691.59	$13,317.76	**-$18,475.47**
8	$30,373.83	$7,500.00	$48,481.31	$4,556.07	$1,883.76	$4,322.43	**$154.79**
9	$225,000.00	$2,803.74	$420,000.00	$8,644.86	$5,607.48	$2,093.46	**-$175,850.47**
10	$250,000.00	$4,380.84	$312,500.00	$10,514.02	$3,329.44	$23,364.49	**-$20,911.21**
11	$35,000.00	$7,009.35	$12,757.01	$3,504.67	$2,803.74	$1,168.22	**$36,728.97**

Using a United States Dollar (USD) to Ghana Cedi rate of 4.28, respondents had their Ghana Cedi quotation converted to USD in order to have a uniform currency for the numerical values. The various numerical values were imputed into Microsoft Excel for the calculation of the life cycle cost. Table 1 represents the computation of the life cycle cost for the selected

commercial real estate developments that provided all variables necessary for the computation.

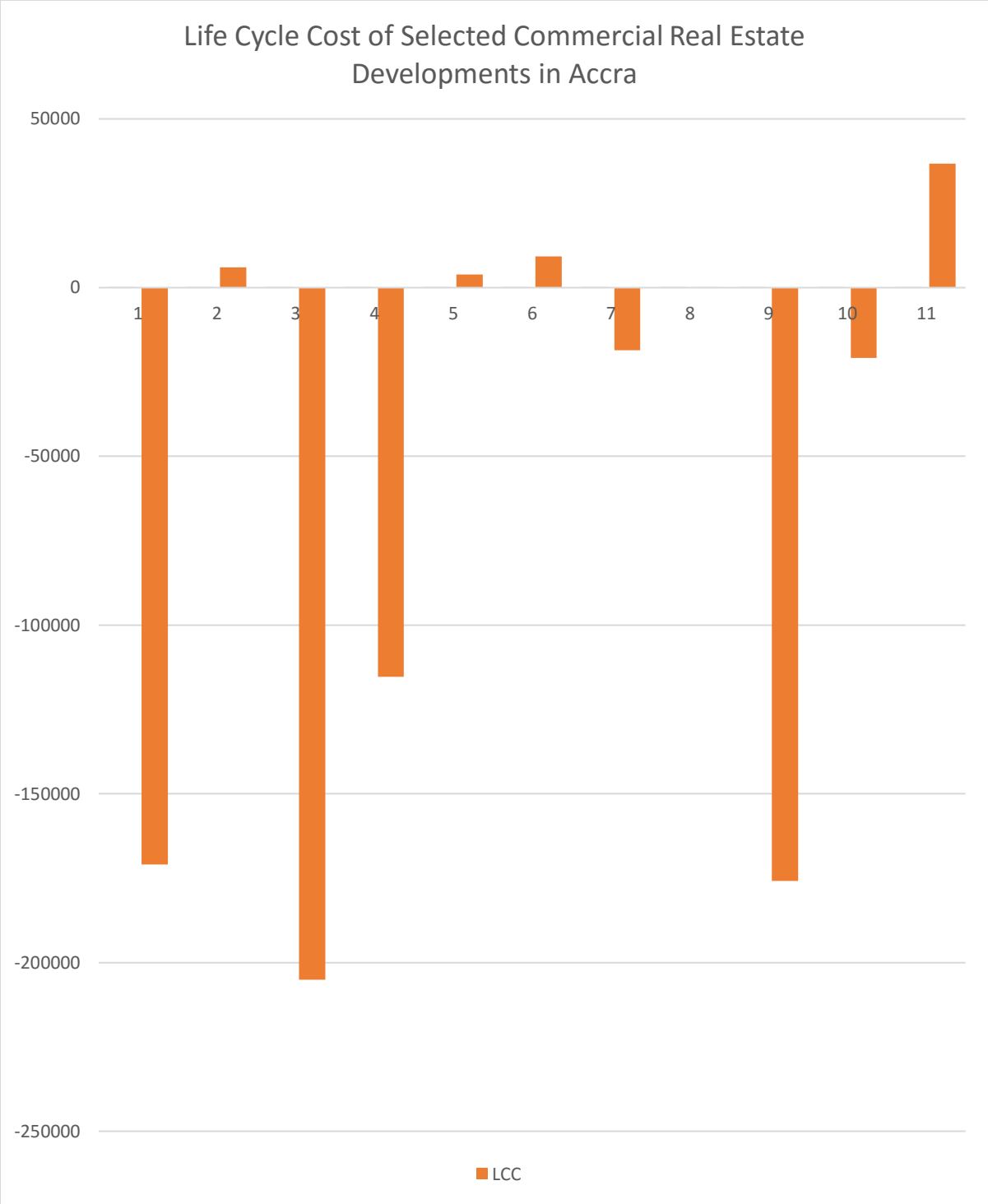

Figure 12: Life Cycle Cost of Selected Commercial Real Estate Developments in Accra

Consequently, Figure 12 serves as the graphical representation of the computed life cycle costs for the respective commercial real estate development. The projects that factored in the tropical setting of the region and sustainability in its building as expected had positive life cycle cost values.

4.4 Conclusion

From the findings and analysis of data, it can be concluded that a building that incorporates sustainability in its building reaps economic benefits as compared to commercial real estate developments that do not factor the tropical region of the location and subsequently the sustainability sphere in its building. The projects that have positive calculated life cycle costs are those that factored in sustainability and the tropical region of the location. Those with negative life cycle values are those that borrowed western building styles and implemented them in Accra without considering the building requirements given the climate characteristics of Accra.

CHAPTER 5: CONCLUSION

5.1 Introduction

This chapter presents a brief summary of the findings, relating them to the initial expectations of the research. It also provides a conclusion drawn from the research and touches on the relevance of the research. It goes on to make some recommendations for future research and discusses limitations of the research.

5.2 Summary of Findings

This thesis had the aim of exploring whether commercial real estate developments in parts of Accra that factored sustainability in their building did reap economic benefits compared to other commercial real estate developments that ignored the sustainability factor. The research is relevant for its role in communicating to real estate development partners the economic benefits of sustainable buildings and will also help in the making of better decisions that positively impact sustainability through economic prosperity. The life cycle cost analysis conducted for these selected commercial real estate buildings indicated the economic benefits enjoyed by one of the developments due to it considering sustainability in its building and generally building in accordance with the building requirements for humid regions. This is shown in Figure 12 (on the previous page) which shows project 2, 5, 6, 8, and 11 having positive values for its calculated life cycle cost. An outcome that was expected given the researcher observing that those projects were in accordance with the building requirements for developments in tropical regions.

5.3 Recommendations

The findings suggest that commercial real estate developments in parts of Accra that factored sustainability in its building and was in accordance with building requirements given the tropical zone Ghana falls in did enjoy some economic benefits when compared to developments that did not factor neither sustainability nor building requirements.

As such these findings are consistent with numerous previous research conducted and existing literature which talks about the economic benefits enjoyed by sustainable buildings and addresses the fear that high initial investment for the development not reaping any benefits

5.4 Limitations

It should be made clear that commercial real estate developments that withheld information regarding financials that were vital to the computation of the life cycle cost were deliberately excluded from the research. The lack of such variables means that the findings that prove the economic benefits spoken of are limited to one commercial real estate development that factored sustainability in its building and was in accordance with building requirements given the tropical region Ghana falls under. Another limitation was the absence of more green certified developments in Accra, Ghana.

5.5 Recommendations for Future Research

Future research into the economic benefits of sustainable buildings should focus on building working relationships with upper-level relevant development partners that hold information about the financials of the commercial real estate. Additionally, researchers should have a

professional valuer ready to compute the resale value of commercial real estate developments that do not have ideas of their resale value and as such would not want to speculate.

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APPENDICES

APPENDIX 1 - QUESTIONNAIRE

This questionnaire is purposed to collect data for an exploratory study of commercial real estate developments in Accra and forms part of an undergraduate thesis study that determines implications of material decisions on the sustainability of commercial real estate in Ghana.

Your participation is voluntary. You reserve the right to stop participating at any point in time and your decisions to do so will not be penalised.

Should you agree to participate, filling this questionnaire will take no longer than ten (10) minutes of your time. All information provided will be kept confidential.

Any questions concerning this questionnaire may be forwarded to me, Brian Elorm Antonio, the researcher at brian.antonio@ashesi.edu.gh.

For further information, you may contact my supervisor, Dr. Sena Agyepong at sagyepong@ashesi.edu.gh

This study and consent form has been reviewed by the Ashesi IRB for Human Subjects Research, to ensure that it does not infringe on the rights of anyone. For further information, you can contact the committee through irb@ashesi.edu.gh

In instances where the exact response is unknown, the respondent can give a rough estimate. Responses will aid the researcher in conducting a life cycle cost analysis of the commercial real estate development in question.

1. What category of real estate development partners do you fall under?
    a. Owner ☐

b. Property Manager ☐

c. Other ☐

_____

2. What is the name of the real estate development?

_____

3. Where is this development located?

_____

4. What type of real estate development is it?

a. Residential ☐

b. Retail shops ☐

c. Office ☐

d. Other ☐

_____

5. What was the initial cost – purchase, acquisition, construction cost – of the development?

_____

6. How much has been spent on replacements for features of the building's systems over the past five to ten (5 - 10) years?

_____

7. What is the current residual value – resale value, salvage value – of the real estate development?

_____

8. How much has been spent on energy bills over the past five to ten (5 - 10) years?

_____

9. How much has been spent on water bills over the past five to ten (5 - 10) years?

_____

10. How much has been spent on non-fuel (e.g. roofing, plumbing, etc.) operating, maintenance and repair costs over the past five to ten (5 - 10) years?

_____

11. Please enter your email address in the space provided if you are interested in the outcome of the survey.

_____