

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**COLLEGE OF ARTS AND BUILT ENVIRONMENT**

**DEPARTMENT OF BUILDING TECHNOLOGY**

**KNUST**

**SUSTAINABLE BUILDING CONSTRUCTION PRACTICES OF GHANAIAN  
BUILDING CONTRACTORS**

**B**

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**Bsc. (Hons.) Quantity Surveying and Construction Economics**

**A Dissertation submitted to the Department of Building Technology, College of  
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Of  
MASTER OF SCIENCE  
IN  
CONSTRUCTION MANAGEMENT.**

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## DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for award of any other degree of the University, except where due acknowledgement has been made in the text.

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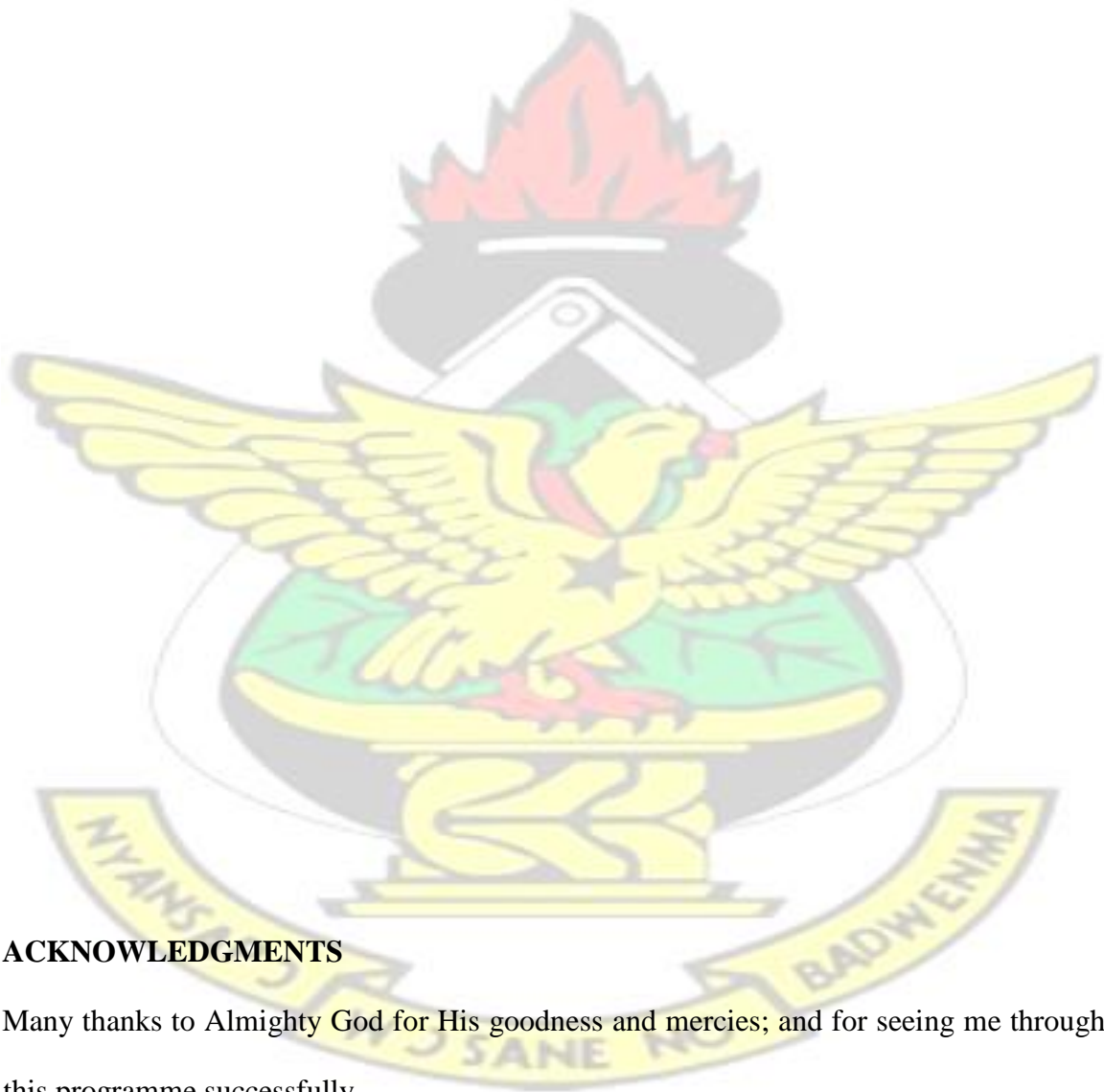
## DEDICATION

This work is dedicated to Mr. Morris Brako & his wife Mrs. Priscilla Agyemang Brako

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## **ACKNOWLEDGMENTS**

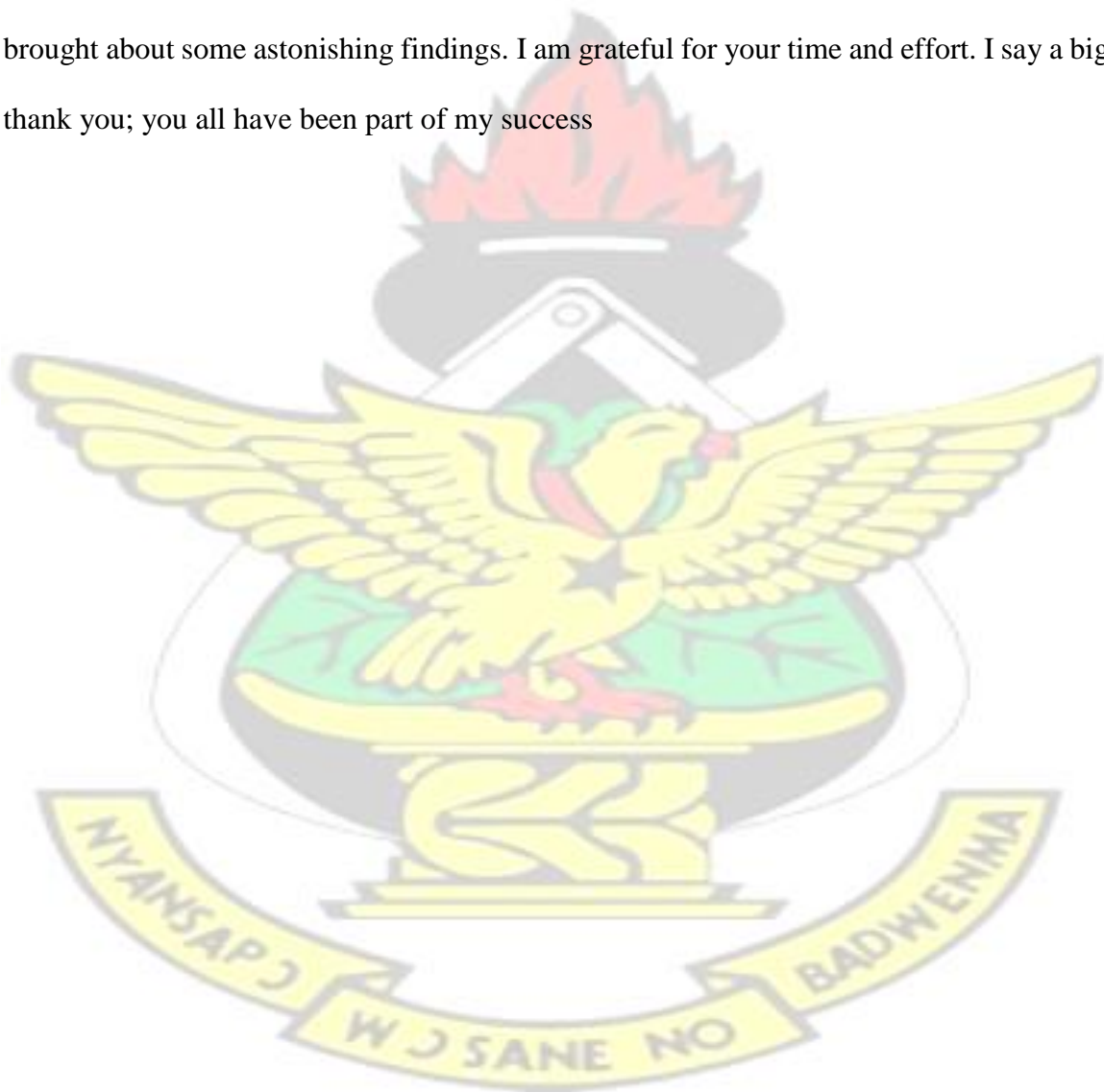
Many thanks to Almighty God for His goodness and mercies; and for seeing me through this programme successfully.

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## **ABSTRACT**

The study investigated the sustainable building construction practices of Ghanaian building contractors. Studies mentioned that a variety of terms are used to mean “sustainable” in the construction industry, including green building, sustainable design, high performance building, sustainable building, and integrated design. Sustainable building construction practices was defined as those construction management practices that seek to minimize impacts on the environment, natural resources, and non-renewable energy sources to promote the sustainability of the built environment. The descriptive survey design was employed to study 60 respondents. Questionnaires were used to collect data from the respondents and analysed using statistical tools and moreover presented in tables and charts. The chi-square test of association was used to test for the level of association where necessary. The study revealed that generally there was a fair idea about sustainable building by respondents. Respondents recounts that installing of efficient energy fixtures, optimizing solar or daylight energy and natural ventilations were good sources of reducing waste and being economic efficient. The study again revealed that high initial cost and the actual cost of projects, lack of research interest, lack of coordination in policies, risk and uncertainties were some of the bottlenecks to the progress of sustainable building construction in the country. About two thirds of the respondents maintained they were not sure those policy framework were good enough to encourage contractors to adopt a more environmentally responsible practices. The study therefore recommend that a more proactive policy framework are put in place by government or other agencies responsible.

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## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the Study

According to Kibert (2005), structures are overwhelming ancient rarities of cutting edge society and imperative social images that effect tremendous populaces in view of their outline, materials, shading, area, and capacity. In the previous decade, wellbeing and ecological issues on development locales have pulled in more consideration. A mixed bag of terms are utilized to signify "sustainable" in the development business, including green building, sustainable design, high performance building, whole building design, sustainable building, and integrated design. Robichaud & Anantatmula (2011), defined green building (additionally alluded to as sustainable design, sustainable development, and different terms beforehand recorded) as 'a philosophy and associated project and construction management practices that seek to minimize or eliminate impacts on the environment, natural resources, and non-renewable energy sources to promote the sustainability of the built environment; enhance the health, wellbeing and productivity of occupants and whole communities; cultivate economic development and financial returns for developers and whole communities; and apply life cycle approaches to community planning and development'. Sustainable construction is a time-tested, useful and intuitive way to crafting environmentally sound buildings. Sustainable building merges age-old wisdom; rehearse and cooperative design processes; and present construction science, knowledge and materials application. Sustainable building consolidates age-old astuteness; convention and community outline procedures; and cutting edge building science, innovation and materials application. Sustainable building structures are vitally productive, preserve assets, make healthier indoor situations and offer tough and

wonderful spaces that utilizes ecologically suitable materials. Sustainable building consolidates incorporated outline ideas, sunlight based introduction, suitable foot shaped impression measuring, coating mindfulness, material toughness, monetary life-cycle examination, material reuse and rescue, normal material substance, provincially accessible materials and financial maintainability.

To advance natural great practice on location, important manuals have been created, for example, Building Employers Confederation (1994), Coventry and Woolveridge (2002), HKCA (2002) and Venables., et al. (2000). The fundamental ranges of concern incorporate great site administration, natural disturbance decrease, and ecologically amicable development hones. The objective of Sustainable development is to make and work a solid based environment in view of asset efficiency and biological outline with an accentuation on seven central standards over the building's life cycle: lessening asset utilization, reusing assets, utilizing recyclable assets, ensuring nature, taking out toxics, applying life cycle costing, and concentrating on quality. All through the outline, development, operation, and end-of-life-cycle forms that make up a building's life, the constructed environment of which it is a section applies both constructive and pessimistic effects on the earth, its assets, the individuals that live on it, and their groups. As a major aspect of the push to diminish these negative natural effects and augment advantages, the idea of "maintainability" has increased far reaching acknowledgment in the course of recent years, enveloping biological, financial and social perspectives, of the constructed environment (Ahn & Pearce 2007). In the building sector, green buildings and development practices include: expanding efficiencies, in this manner sparing vitality, water, and different assets; outfitting fulfilling, gainful, sound, and top notch indoor spaces; utilizing ecologically best materials; and instructing building tenants about proficiency and protection (Ahn and Pearce 2007; Kibert 2008). The majority of the



standard considerations on green building spotlights on its positive natural effects; research demonstrates engineer's choice to make strides toward environmental friendliness stays established in its financial practicality. A study of more than 400,000 draftsmen, specialists, and foremen directed by McGraw-Hill Construction (2006), demonstrated that the possibility to lessen vitality expenses was chosen by 54% of respondents as the top explanation behind building green. The Davis Langdon study (2004), found that there are wide varieties in expenses connected with economical ventures and traditional undertakings.

In Ghana, sustainable (green) building is gradually gaining root following the establishment of Ghana Green Building Council (GGBC), a non-governmental organization and private-public partnership formed in 2009, that is committed to help create sustainable buildings/communities in Ghana using energy savings, water conservation, resource management and cost-efficient techniques. The GGBC provides green building resources, education and leadership opportunities to all stakeholders in the construction industry to help in the transformation process towards sustainability. This has led to real estate agencies such as Global Green Built Ghana, SGS building and others to go into sustainable building. It is therefore necessary to identify sustainable building practices that can be implemented over the building's entire life cycle to reduce its environmental impact, maximize social and economic opportunities, and improve satisfaction and comfort.

## **1.2 Statement of the Problem**

The building and construction sector assumes a noteworthy part in the supportability of a general public and the world (Halls and Rovers, 2003). To decrease the negative natural effect of development exercises and to enhance the operation of construction sites, it is key



to audit and evaluate the essential issues and components of the development process. Building industry specialists have started to pay consideration on controlling and redressing the ecological harm because of their activities. Draftsmen, planners, specialists and others included in the building procedure have one of a kind chance to decrease ecological effect through the usage of maintainability targets at the outline improvement phase of a building venture (Kibert 2008).

The growing awareness of sustainable construction's potential to positively impact environmental issues is pushing green building to the forefront. Thus, more local governments are embracing green building guidelines and regulations or giving allowing and financial motivators to practical improvement. Research information show sensational increments in the quantity of advancement ventures looking for ecological certification, demonstrating that the interest for green development is additionally on the ascent (U.S. Green Building Council 2006). As purchasers turn out to be more instructed about ecological alternatives and green private development, and as policymakers expand impetuses for green improvement and limit ordinary advancement endeavours, some building foremen may be at an aggressive detriment if they have not integrated sustainable design and construction principles into their operations. It is upon this setting, that the researchers investigates the sustainable building construction practices of Ghanaian building contractors, delving into barriers contractors face in coming out with sustainable buildings.

### **1.3 Objectives of the Study**

The main objective of the study is to investigate sustainable building construction practices of Ghanaian building contractors. The specific objectives were:

1. To assess the level of awareness of sustainable building construction among

Ghanaian Contractors;

2. To identify the primary barriers to sustainable building projects; and
3. To assess availability of government programmes that ensure sustainable building projects.

#### **1.4 Research Questions**

In order to achieve the specific objectives of the study, the following questions were formulated;

1. What is the level of awareness of sustainable building construction among Ghanaian Contractors?
2. What do building contractors see as the primary barriers to sustainable building practices in their professions?; and
3. What are some of the available government programmes that ensure sustainable building projects?

#### **1.5 Significance of the Study**

The study will serve as a guide to the following groups of bodies and agencies, Ministry of Housing and Water Resource, Real Estate Agencies, private contractors and stakeholders in the industry. The study will help these bodies to formulate policies and bring out guidelines for implementing sustainable building as it exist in other countries. The research will further expose building contractors to the current trends in the industry; thereby helping them to gain competitive advantage. Students can also use this study as a base for further research.

#### **1.6 Delimitation of the Study**

The research work was limited to sustainability practices of Ghana Building contractors.

### **1.7 Limitation of the Study**

The researcher faced a number of challenges in carrying out the study. These challenges brought about some limitations in the study. Some of these challenges are as follows:

A larger sample size would have given better results but due to limited time in submitting the research work, the research was limited to building contractors in the Sekondi-Takoradi Metropolis. It is worth noting that larger sample sizes affect the generalizability of a study positively, thus choosing that sample is somehow problematic. Secondly, some of the handwritings of the respondents were not legible and therefore were not included in the analysis of the data. In fact this affected the sample size of the study. For others the researcher had to improvise, this thus affected the conclusions of the study. Questionnaires with less than 80% response rate were removed from the data set.

### **1.8 Organisation of the Study**

This study is organized into five chapters. Chapter One introduces the study and it consists of background of the study, statement of the problem, purpose of the study, research questions, objectives of the study, significance of the study, delimitation of the study, limitation of the study. Chapter Two reviews related literature. Chapter Three which deals with research methodology includes research design, sources of data, sampling procedure, data collection and data analysis. Chapter Four presents the analysis and findings of the data collected. Chapter Five finally provides a Summary of the major findings, conclusions and recommendations offered based on the research findings.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

## **2.1 The Concept of Sustainable Building**

In the construction business, the Green Building Concept has advanced and appeared in its some structure and it has now been picking up its force quickly over the world. Structures are an inseparable piece of society; they harbour the spots where we live, play, learn and work. Despite the fact that the rate of time spent inside shifts broadly around the world, natives in created nations, for example, the United States, spend about 90 for each penny of their time inside (American Physical Society, 2008). As focuses of our social and economic lives, structures are additionally the wellspring of an awesome offer of our ecological effect. The meaning of what constitutes a green building is continually advancing, the US Office of the Federal Environmental Executive offers a valuable working definition. This organization characterizes this term as: the act of (1) expanding the proficiency with which structures and their destinations use energy, water, and materials, and (2) decreasing building effects on human wellbeing and the earth, through better siting, outline, development, operation, upkeep, and evacuation—the complete building life cycle.

So also, the Environmental Protection Agency (EPA) characterizes green building as takes after: The act of making structures and utilizing procedures that are naturally mindful and asset proficient all through a building's life-cycle from siting to outline, development, operation, upkeep, remodel and deconstruction. This practice grows and supplements the established building configuration concerns of economy, utility, strength, and solace. Green building is otherwise called an economical or 'elite' building.

Coordinating sustainability in the configuration and development of new and existing structures results in more proficient utilization of characteristic and money related assets, and structures that all the more altogether address the social dimension, as opposed to



developing structures to ordinary gauges and afterward later retrofitting for supportability. As per Hill and Bowen, (1997), Green building outline and development can take numerous structures. Natural outline systems normally can be categorized as one of two ideal models: inactive or dynamic building configuration. Through detached outline, structures utilize plan techniques that exploit the qualities of the building site, insolation, microclimate, and different components to meet lighting, warming and cooling needs. Case in point, normal ventilation and day lighting enhances the building tenants' wellbeing and prosperity without the utilization of dynamic innovation. The second approach incorporates dynamic frameworks, for occasion innovations that lessen the effects of vitality creation or utilization, for example, photovoltaic or warm sunlight based boards or vitality proficient machines, to accomplish more noteworthy general operational effectiveness (UNEP, 2011).

Sustainability is a wide and complex idea, which has become one of the real issues in the building business. The thought of maintainability includes upgrading the personal satisfaction, therefore permitting individuals to live in a solid situation, with enhanced social, financial and ecological conditions (Ortiz, Castells and Sonnemann, 2009). The start of the twenty-first century has introduced the period of green structures. As indicated by a few assessments, there are give or take 81 million structures in the United States (U.S. Dept. of Energy Buildings Technology Program, 2009). Kat (2003), contends that Green' structures are a subset of sustainable development, speaking to just the structures. As a result really reasonable "green" business structures that are intended to be practical in the feeling of renewable energy frameworks, shut materials circles, and full mix into the scene are rare to non-existent. In short Green building is a configuration and development hone that advances the financial wellbeing and prosperity of the Family, the group and the earth. A savvy venture toward individual monetary gains, green building has positive social and



ecological implications that declare your dedication to the future and the way we live for a considerable length of time to come.

## **2.2 Impacts of Conventional Buildings That Green Buildings Seek to Rectify**

As per USGBC (2007), If a large portion of new plug structures were constructed to utilize half less energy, it would spare more than 6 million metric huge amounts of carbon dioxide every year for the life of the structures—the likeness taking more than 1 million autos off the street consistently. It is presently generally acknowledged that handling natural sustainability alone is insufficient and that an all addressing so as to encompass methodology ought to be looked for each of the three standards of feasible improvement to be specific social, financial and ecological. In the UK, in 1999 the Department of environment, transport and areas (DETR) characterized sustainability as social advancement which perceives the needs of everybody while giving compelling security of the earth by reasonable utilization of common recourses guaranteeing upkeep of high and stable levels of monetary development and business (Mawhinney, 2002). This obliges an adjustment in way of life (Hale and Lachowicz, 1998) as, for instance, living in a low energy house however having expansive carbon foot shaped impressions for other every day exercises, for example, transport, sustenance, waste and foundation will bring about an unsustainable example of living. Wines (2000) contends that the vast majority support of the progressions endorsed by ecological changes if they don't bring about changes in way of life or have an effect on personal satisfaction.

As per Sappe (2007), amid the last 30-40 years, the world has been detecting the sharp experience of a worldwide temperature alteration, ozone exhaustion, asset consumption, lack of energy, environmental poisonous quality, human lethality, corrosive downpours and so forth. These have frightened, rather than urged the humankind to change the way

they work on earth. Despite the fact that we can't abstain from influencing the earth, the green structures will point and contribute towards minimizing the ecological effect. Reed and Gordon (2000), accentuated that green structures don't just contribute towards a sustainable development and environment yet it likewise conveys loads of advantages and preferences to the building proprietors and the clients. It contributes towards lower advancement expenses, lower working expenses, expanded solaces, healthier indoor environment quality, and upgraded toughness and less upkeep costs. Cutting edge development causes undesirable ecological effects and constraining these effects is inside the scope of green building. Maybe the most effortless approach to comprehend green building is to first consider the different ecological effects that structures produce and after that consider how negative effects can be lessened or dispensed with through more powerful arranging, outline and development. As indicated by Faiola and Shulman (2007), current structures affect nature in the accompanying ranges: site choice, materials and assets, energy utilization and air contamination, water utilization and quality, and indoor air quality.

### **2.3 Hindrances to Green Building Project**

The hypothesis for making a sustainable building is useful, however the substances of the construction business and obliging powers can dissolve high standards. These can be seen as hindrances yet this is a negative methodology, on the off chance that we try to completely comprehend the issues from the perspective of the greater part of the partners and the difficulties they confront it gets to be simpler to have effective results (Fieldson, 2007). As indicated by Stang and Hawthorne (2005), a noteworthy snag to maintainable outline is that there are modellers who are not concerned with green building design as they trust that energy effectiveness and structural stylish are two clashing components and

are careful that the name 'green engineer' may influence their open recognition. It is a need for the design community to show great bits of structural engineering that energy effectiveness and aesthetic are perfect and not clashing. Langdon (2007), contends that present obstructions include:

### **Steep industry expectation to absorb information**

Langdon reports that there is a general absence of information about the financial and ecological advantages of sustainable structures, and additionally a shortage of nature with green building ideas and practices.

### **Monetary contemplations**

Current monetary approaches order generally quick paybacks for energy proficiency changes. To fund "more profound" retrofits (framework updates and enhancements to building envelopes), which may yield some beginning monetary favourable circumstances, however much more prominent working reserve funds after some time, ventures with lower rates of return and more payback cycles ought to be considered.

### **Hindrances to Implementation**

Divisions and subsidizing substances are more averse to support energy and framework related projects over higher-perceivability changes, for example, a play area or new wing. However a study by Guy and Moore (2005), in three nations to be specific Mexico, United States and Canada distinguished the accompanying obstructions.

### **Separate Capital and Operating Budgets**

Guy and Moore contend that numerous legislatures at the government, state, and local level, and in addition open and private establishments, fitting trusts for land acquisitions

freely from stores for property operations. This partition makes an accounting situation where the investment funds from the operation of green structures is not used to balance any beginning higher development costs. Understanding the life-cycle expenses of a building is still a significant test. A building's introductory development costs commonly may speak to just 20 to 30 percent of the building's whole expenses over its helpful life, underscoring the need to consider the starting expense of the building as well as the year-to-year working expenses; additionally, proprietors of venture property regularly assess development and working expenses over a holding time of ten years or less (Gazeley, 2008).

### **Split Incentives**

Regularly the one paying the bill and the one catching the benefits contrast. A designer may not be keen on paying for green elements when the benefits will be gone on to the new proprietors or inhabitants unless, obviously, he finds himself able to recover the extra cost of green elements in the deal value or venture pay figured it out. BERR (2008), confirms this by reporting that the split motivating force issue is especially apparent for new homes and townhouses and for non-proprietor involved existing business structures where, due to high turnover rates, proprietors may need short payback periods on energy sparing speculations.

### **Perceived Higher Cost**

Higher perceived or genuine first expenses of numerous green building systems and advancements are a significant disincentive. A study discharged by the World Business Council (2007), on Sustainable Development found that key players in the land business



exaggerated the expense of green building by a normal of 300 percent, evaluating the expense to be 17 percent above ordinary development, more than triple the expense assessed by the study's creators of 5 percent. Specialists talked with 1,423 individuals in Japan, China, Brazil, the United States, Spain, France, and Germany. Another key expense obstruction is the instability that engineers, land experts, and some capital suppliers feel about green building. Engineers and other leaders may have foremen, subcontractors, materials, and administration suppliers lined up for conventional building or retrofitting; moving to green building may oblige new administration suppliers, materials merchants, and the execution of an incorporated configuration process keeping in mind the end goal to manufacture green at an equivalent expense.

### **Danger and Uncertainty**

In spite of the fact that ventures and enthusiasm for green building are becoming quickly, for various perplexing and fluctuated reasons, the money related case for green building has not yet firmly grabbed hold in the land and improvement group. As indicated by the U.S. Green Building Council. (2006), the accompanying dangers exist in the land group with respect to green structures: Uncertainty over unwavering quality of green building innovations; Uncertainty over expenses of creating of green land; Uncertainty about the monetary benefits of green land; and vulnerability about green building execution after some time. Hyde (2007), notes that in the United States, while capital is starting to move into green business land speculation, numerous green designers report that loan specialists and speculators are hesitant to perceive extra venture esteem in green components as for vitality cost funds or purchaser advance." Similarly, numerous commercial real estate lenders and financial specialists feel that they are 'flying visually impaired' when solicited to evaluate the quality from green business real estate, taking note of the absence of giving



and speculation rules managing specifically with green structures (United Nations Environment Program [UNEP], 2007).

### **Absence of Experienced Workforce**

Guy and Moore (2005) further reports that one obstacle referred to over and over by numerous however not investigated well in the writing and exploration, is fast industry development undermining to intensify the issue of the absence of experienced specialists and along these lines expanding the danger of unpractised or untrained administration suppliers entering the green building business sector looking for a premium on their administrations.

### **Absence of Coordination and Consistency in Government Policies Affecting Building**

A study by Kibert (2005), recognized how the absence of coordination and consistency in government strategies can go about as a boundary to green building. Case in point, construction laws can frustrate the utilization of option building materials and creative configuration techniques, inadvertently require naturally destructive practices, and neglect to require earth best practices. Regarding financial motivations, Canada does not have a thorough government act coordinated at people like the Energy Policy Act in the United States and commonplace endeavours are not generally all around composed. In Ontario, for instance, districts are not allowed to command any execution necessities over those needed by the Ontario Building Code.

### **Absence of Research Investments**

A report observed that US subsidizing for research identified with green building practices found the middle value of \$193 million for each year from 2002 to 2005. This speaks to

just 0.02 percent of the evaluated yearly estimation of US building development and 0.2 percent of all government research (US Green Building Council, 2007). Progresses in green building exploration can bring about vast purchaser reserve funds and an in number profit for ventures. The United States National Academy of Sciences discovered various exceptional profits for speculations connected with green building elements. Case in point, a DOE speculation of \$4 million being developed of low-emissivity coating yielded total shopper cost reserve funds of \$8 billion through 2000. With electronic stabilizer for fluorescent lighting, DOE contributed \$6 million and buyers acknowledged aggregate funds of \$15 billion through 2000 (National Academy of Sciences, 2001).

#### **2.4 Sustainable Building Cost Management**

While a large portion of the standard consideration on green building spotlights on its positive natural effects, examination demonstrates an engineer's choice to become environmentally viable stays established in its financial feasibility. A study of more than 400,000 draftsmen, specialists, and foremen directed by McGraw-Hill Construction (2006) demonstrated that the possibility to decrease vitality expenses was chosen by 54% of respondents as the top explanation behind building green. In this study, just 24% of respondents expressed that green building's quality to nature was the main impetus behind their association in the business. At the point when gotten some information about the hindrances to green building, respondents picked higher introductory expenses as the best impediment. The Langdon study (2004) found that there are wide varieties in expenses connected with maintainable undertakings and routine activities.

Albeit starting expenses of green development can be higher than ordinary ventures, it is broadly held that more drawn out term cost investment funds in operations and upkeep can help recoup those expenses. Green structures are relied upon to decline working expenses

between 8–9%, expansion aggregate building worth by around 7.5% and expand inhabitation rates by 3.5% (U.S. Green Building Council 2006). Be that as it may, the benefits of operational funds can be less vital to a theoretical designer who has no long haul enthusiasm for working or renting a building. Therefore, it is vital for venture chiefs to create methodologies for containing expenses amid the beginning periods of an undertaking. A usually noted test to containing expenses in customary development ventures is absence of powerful correspondence among different specialized specialists who tend to utilize their own particular devices, convention, and industry models for settling on choices and following data (Sappe 2007). Modellers, architects, and manufacturers have a tendency to be exceedingly particular and convey administrations in specialized disengagement. When this "storehouse impact" rolls out, it is difficult to oversee improvements, moderate dangers, and contain costs with a comprehensive perspective of the task. It likewise represses the venture from exploiting framework improvement, which can spare time and cash (Reed and Gordon, 2000).

Research by BRE (2007); and Sweett (2005), propose that the expense premium to accomplish great practice as characterized by Breeam (2008), are somewhere around 1 and 10%. In light of work area top studies conveyed by Davis Langdon, the evaluated capital expense premiums of securing dynamic decreases in carbon outflows over statutory essentials for distinctive abiding sorts as an aftereffect of a blend of fabric improvement and LZC may extend from 1.7% to 12.7% (Rawlinson, 2008). Structures are once in a while created without a concurred accessibility of trusts which regularly are topped by some point of confinement, by government spending plans, gifts and altruistic subsidizing or capital consumption. On the off chance that something is not considered monetary, it won't be told. Venture administrators would not have any desire to acknowledge the

outcomes of neglecting to deal with their financial plan, or it may be that a key useful component of the building would need to be relinquished (Schoon, 2008).

As indicated by Greenspec (2008), a supportable building which does not capacity well as far as space, offices or social openness will be as a lot of a natural weight through absence of use as a well-working building with a high operational carbon sway. The exceptionally fundamental appraisal requires the computation of capital or introductory expense with running expense/upkeep however the procedure is more intricate obliging learning administration nearby corporate obligation assessment to give better choices in expense assessment for manageability including quality through outline is basic to any building which needs to draw in clients to be effective, from guest focuses and historical centres to games offices and general stores (Kibert, 2005).

Open discernment and enthusiasm for manageability and the learning capability of obvious renewable vitality era is vital. Numerous other maintainability measures are less simple to see and must be conveyed in different ways which may bring about positive attention. Clark (2008), contends that to truly comprehend the advantages gave by great ecological configuration, long haul investigations of vitality utilization, inhabitant wellbeing, joy and efficiency must be completed. Natural configuration has a budgetary expense, and once in a while it has a social cost as well. These expenses must adjust and be defended. In business development, the expense of neglecting to address matters of maintainability can be humiliating and exorbitant as far as indictment, terrible media scope and loss of exchange (Murray (2007). Business partners are by and large progressively proficient in natural and moral matters, making expense examinations for an entire building drawn out and excessive in term of outline consultancy fees.



## **2.5 The Role of Sustainable Building Organizations**

Kats (2012) reports that the appearance of green structures has been driven by a wide assortment of associations around the globe. A percentage of the key American associations driving this movement in deduction have been the U.S Green Building Council, the U.S. Branch of Energy, the National Association of Home Builders, the Department of Defense, and other open and non-benefit organizations. The private area has been driven by a few producers, for instance Interface Flooring whose Chairman, Ray Anderson, guided its move from being an ordinary rug tile maker to one that construct its corporate theory in light of mechanical nature. The merging of the work of these associations over the previous decade has brought about a green building development with a wide assortment of accessible items. On the worldwide scene, IISBE (International Institute for a Sustainable Built Environment), has led the pack in the enclosure of building appraisal and experimenting with new thoughts in a sensibly vast number of nations.

Maybe the key association occupied with green expanding on a universal premise is a moderately new one, the International Institute for a Sustainable Built Environment (IISBE). IISBE fundamental endeavours at present is to give an entrance to an extensive variety of green building data. IISBE likewise has assumed control association of the semi-annual Green Building Challenge and Sustainable Building Conference. IISBE additionally serves as the focal point of worldwide movement in endeavours identified with manageable building evaluation, particularly with its fundamental appraisal technique, Green Building Tool (GBT). GBT is utilized at these half-yearly meetings to evaluate or rate participants from various national model structures around the world.

In Ghana, The Ghana Green Building Council has been a noteworthy power in the supportable building industry. The board was set up on August twelfth 2009 with the mission to change the fabricated environment in Ghana towards manageability through the



way groups are arranged, composed, built, worked and kept up. The gathering has the accompanying targets;

- i. To create and advance a rating instrument framework that is acknowledged and perceived in Ghana.
- ii. To convey attachment to the green building development and give clarity and coordination of exertion and arrangements.
- iii. To battle for activity by government, industry and some other body who has a part to play in conveying supportability in the assembled environment.
- iv. To set up approach in regards to green building for Ghana.
- v. To impact others to bolster the development of green structures in Ghana.
- vi. To urge open private associations to further encourage the uptake of green structures.
- vii. To impact partners to bolster the development of green structures.
- viii. To support industry and chiefs to assume a key part in making and reproducing structures.
- ix. To helping so as to bring issues to light of GBC individuals partake or add to gatherings and distributions which bolster green manufactured environment.

The gathering is teaming up with the service of Environment Science and Technology, Ministry of Local Government and Rural Development, Ministry of Water Resources Works and Housing among other office and Agencies, Institutions of Higher Learning and Organizations. The committee at a function in 2012 made a striking stride in making a reasonable domain with the dispatch of the Eco Communities National Framework. The Eco Communities National Framework is a dream, an arrangement of guided standards and goals serving as the premise for the advancement of the rating device for groups, neighbourhood, and urban areas improvement in Ghana. The point of this system is to

make a stage, give motivation and add to national improvement on how we plan, outline, develop, work and keep up and recharge practical groups in Ghana. Asaase

(2012) reports that in the location of Mr. Foster Osae-Akonnor, Chief Executive of the Ghana Green Building Council watched that Ghana is developing at a quick pace, exemplified by expansion in development exercises, inundation of remote speculations, oil find among others which debilitate the manageability of our surroundings in a major manner. He repeated that the Ghana Green Building Council right now remains as the organization of decision to accomplice government and all partners in the building and development industry, including unified industry and bodies to lead the improvement of a method of reasoning that could help make a more noteworthy interest for more maintainable advancement ventures at a group scale.

The Ghana Green Building Council is an enrolment based association that is resolved to help make maintainable building and groups in Ghana utilizing vitality reserve funds, water preservation, asset administration and expense productive methods.

## **2.6 The Need for Regulation in the Sustainable Building Industry**

Aitken (1998), completely expressed that one of the real motivation behind great administration is to force singular performing artists to settle on all things considered insightful choices; in light of a legitimate concern for general wellbeing, security, or welfare, through administrative arrangement (obliging and restricting certain activities) or non-administrative strategy (making impetuses for or just reassuring and encouraging certain activities). Open strategies and projects serve to regularize great practices quicker than they would spread without government intercession, when business powers are not adequate to advance those practices or are making deterrents to their reception. Government has an obligation to mediate where private activities are undermining more noteworthy else's benefit, as they are on account of building practice. The building

business, the legislature, and general society everywhere have the obligation regarding finding out about, instructing others about, requesting, and actualizing more reasonable building practices. In any case, general society segment is in some cases in a superior position to impact change than the private part is. For instance, a few wards have attempted new practices inside, such as commanding higher vitality proficiency models or reused substance materials for open structures (UNEP 2007). Their analyses and involvement with "tidying up their own home," in a manner of speaking, help serving to set up the validity of such practices, consequently sparing private elements from having the assume that hazard. Additionally, government inclusion can give authenticity to the ecological support endeavours of non-benefits, since government is relied upon to have a more goal or moderate point of view than backing gatherings. Moreover, in light of the fact that the building business does not put as much in innovative work as most different commercial enterprises do, the administration must help goad development around there (McGraw-Hill Construction, 2006).

## **2.7 Outline of the National Building Regulations (NBR)**

The National Building Regulations is an administrative instrument L1 1630 of Demonstration 1996 commanded by the Local Government Act 462 of 1993. The obligation regarding the National Building Regulation lies with the Pastor of Water Assets, Works and Lodging by goodness of Segment 63 of Demonstration 462.

The centre standard of the National Building Regulations (NBR) like most National Codes is the procurement of rules for wellbeing, Wellbeing and Administration. The Organization of the NBR is the obligation of the Neighbourhood Government Framework as spoke to by Area, City and Metropolitan Powers. Like most Codes or Regulations, the NBR consolidates Arranging – Outline – Development organized in 19 Sections as compressed underneath.

1. Use of regulations and building Arrangements

2. Plot Advancement
3. Site Arrangement and Scene
4. Materials for building
5. Basic Soundness
6. Basic Flame Safety measure
7. Access Settlement
8. Air Development and ventilation
9. Warm Establishment
10. Hearths, Smokestacks and Warmth Creating Apparatuses
11. Sound Establishment
12. Vermin control and Insurance Operators Rot
13. Seepage
14. Sterile Accommodations
15. Reject Transfer
16. Water supply
17. Lighting and electrical Establishments
18. Extraordinary Necessities FOR Provincial Structures
19. Different Procurements.

The improvement of the NBR has its genesis from the Town and Nation Arranging Law (Cap 84) OF 1945. This genesis has permitted certain parts of the NBR identified with pre-freedom period to be kept up making them immaterial and out-dated. The fundamental centre of the NBC has been the wellbeing, security and accommodation of individuals and groups without any accentuation on flow worldwide issues of Natural Assurance and Preservation, Vitality effectiveness, water protection and administration and Calamity Hazard decrease. While the NBR stresses building quality and wellbeing, the organization



of the NBR in admiration of the Allowing procedure and the authorization of the regulations is extremely frail. At present the NBR has been being used as an administration archive for a long time without amendment. According to best worldwide practice rules the NBR has missed 5 corrections. In that capacity any amendment must try to address present and future natural, innovative and financial difficulties. At present, there is another arranging law for thought and referral to Parliament as a law. The reason for this law is the absence of an intelligible authoritative instrument that controls area utilization arranging, organization, and administration. The strategy is gotten from the general Human Settlement Approach (HSP) structure of Ghana.

The HSP system manages different parts of the financial advancement plan with accentuation on the accompanying:

- Unique arranging in an expansive perspective
- Effect of key monetary arrangement on extraordinary arranging and demography.
- Models and procedures of area utilization arranging and its effect on human settlement. The wide target of the law is to principally guarantee that arranging as an improvement is utilized to encourage:
  - Financial Development and Advancement
  - City and Urban Recovery
  - Best Worldwide Practice in Area Utilization Arranging and Organization

The physical procedures of arranging and lodging advancement is all that much a nearby group matter. The part Metropolitan, Civil and Area Gatherings in empowering, advancing and encouraging the procurement of lodging to all portions of the populace are under their ward, and can hence underlined critical issue. The unlucky deficiency of real, utilitarian and suitable local power structures will imperil both the pace and nature of usage of lodging projects.

The Region Gatherings as of now have sub-boards for base and Social Administrations separately. A mix of these sub-councils has the fundamental elements for a Locale Country Lodging Advisory group. The undertaking for formalizing such a council rests singularly with the Service of Local Government, Country Improvement and Service of Environment however this once more, must be started by the Service of Water Assets, Works and Lodging. It may not so much oblige an authoritative change subsequent to specific conditions of the Local Government Act, 1993 (Act 462) PNDC Law 207 can be translated to suggest obligation regarding encouraging lodging conveyance.

The Town and Nation Arranging Office is one of the decentralized offices under the Metropolitan/Civil/Area Congregations and key specialists in the area conveyance and advancement process. There is require however to patch up the current enactment as it is not meeting the difficulties of the present urbanization process. The authoritative methodology to acquire arranging consent and improvement grants are bulky and force on the candidate considerable use as far as time and cash. The present system forces the weight on the candidate to guarantee that consent is conceded. The Town and Nation Arranging Statute (Top 84) is mind boggling and disputable and it is key that new Arranging Enactment ought to supplant it, as the present law has demonstrated unequipped for tending to all difficult

## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.0 Introduction**

This chapter discusses the procedures and techniques used to obtain and analyzed the data for the study. It describes the research design, study area, population, sample design and sample size, data collection instrument, and tools for the data analysis.

#### **3.1 Research Design**

A research design comprises the method and processes used to conduct scientific research. This research design for the study was non-experimental whose purpose is to collect detailed information to describe an existing fact. Non-experimental research designs according to Creswell (2012) do not involve a manipulation of the situation, circumstances, or experience of the participants. The study was non-experimental because the study designed was used to develop theories, identify problems with current practices or make judgments. A descriptive survey was used in conducting the research. This design agrees with Flick (2009) assertion that qualitative survey design is a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem.

#### **3.2 Population and Sample Characteristics**

A population is a complete set of agents (persons or objects) that possess some common characteristics. The populations of interest to the researcher was building contractors whose operations resides in the Sekondi-Takoradi Metropolis. This is because they had the relevant information needed for the study. Sample is the selected agents (people or objects)

taking part in a study; people are denoted to as subjects or participants. In all 40 building contractors from 20 constructions firms were used for the study. The figure is arrived at after obtaining a sample frame from the Sekondi-Takoradi Metropolitan Assembly. Two-thirds of the sample frame was used. This was done to boost the generalization of the findings.

### **3.3 Study Area**

The study was directed inside Sekondi and Takoradi; the twin city of Ghana. The study zone (Sekondi-Takoradi Metropolis) is the territorial capital for the Western Region with Sekondi as its regulatory capital. The city possesses the south-eastern piece of Western Region and shares limits with the Ahanta West Municipal and the Shama locale. It is situated on the West Coast of Ghana and it speaks the truth 200km west of Accra and 130km east of La Cote D'Ivoire. It is the most very created of the 13 locale of the Western Region and it is likewise the fourth biggest city in the entire of Ghana and a mechanical and business focus. It covers a region of 23,921 kilometers square with a populace of 559,548 (Ghana Statistical Service, 2012). Angling and cultivating is the fundamental occupation for people in the rustic ranges. With the late oil discover, the city has turned out to be exceptionally cosmopolitan. This is because of the way that the oil find has made a great deal employments which thus has brought about deluge of individuals from different spots into the city.

### **3.4 Sample Size**

Sample size frankly examines how colossal or tiny the sample have to be to form a basis for representation (Sarantakos, 2005). The sample size was made of 40 building



contractors, from 20 construction firms whose firms have been duly registered with the Sekondi-Takoradi Metropolitan Assembly (STMA) and whose operations are in the

Sekondi-Takoradi Metropolis. This study adopted the Fisher, Laing, Stoeckel and Townsend (1998) formula for determining sample size. The formula is given as;

$$n = \frac{z^2 pq}{d^2}$$

Where; n = the desired sample size (when the population is greater than 10000); z = the standard normal deviation, usually set at 1.96 which corresponds to 95 percent confidence level; p = the proportion in the target population estimated to have particular characteristics; q= 1.0-p; and d= degree of accuracy

desired, usually set at 0.05.

Thus, the study assumes a certain proportion for the target respondents and then works it out. Assuming the target population of both contractors and engineers in the Sekondi-Takoradi metropolis (p) is 28% which is equivalent to 0.28, with the z statistic being 1.96 and the degree of accuracy set at 95%. The significant value of this research was at 0.05 significant which means that this research expected that the degree at which responses from respondents to research questions are likely to be false is at 5%. This is to increase its representativeness and good to answer the research objective.

The sample size (n) for the communities was found to be is as follows:

$$n = \frac{(1.96)^2(0.28)(0.72)}{(0.05)^2}$$

An estimated sample size (n) of 20 respondents was arrived at. However, due to the thought of better representation it was multiplied by two.

### **3.5 Sampling Technique**

A combination of probability and non-probability sampling techniques was employed for the study. The simple random sampling technique which is a probability method was used

to sample 20 construction establishments in Sekondi-Takoradi; using a sampling frame obtained from the Sekondi Takoradi Metropolitan Assembly (STMA) Office. Equal proportions of 2 contractors were assigned to the 20 construction firms in Sekondi-Takoradi. This was done to ensure a better representation of the entire units in the sample. The convenient sampling technique, a non-probability method, was then be used to select the respondents for the study. Convenient sampling is a kind of technique where the researcher selects anyone who comes the way of the researcher. It is less expensive and less cumbersome. Furthermore, a pilot study was conducted in June, 2014 using two (2) construction outlets: each from the Takoradi and Sekondi, administering 8 questionnaires to test the appropriateness of the questionnaire items and respondents understanding of the questions. This assertion is similar to that of Creswell (2007) who indicated that a pilot study is normally carried out for a questionnaire with the aim of ensuring that respondents have no problems responding to the items and also to ensure the reliability and validity of the items in the questionnaire.

This was necessary because of the anticipated difficulty in accessing a list of contractors and their contact details, which made it impossible to draw up and apply a sampling frame.

### **3.6 Data Collection Instrument**

The data was obtained by means of a self-administered questionnaire. A questionnaire is a data collection tool by which people respond to a set of standard questions in a predetermined way (Creswell, 2003). The respondents read the questions, interpreted its anticipated meaning and provided the likely responses. Questionnaire surveys help to characterize the features of the target population in relation to the identified variables and also ensure reliability. The content of the questionnaire was flawless and straightforward. The format of the survey was made simple to peruse and charming to the eye with a

precisely outlined arrangement that made it less demanding to take after. To ensure that the responses represented the views of the respondents, the questionnaire was made up of both open-ended and close-ended questions. Open-ended questions are questions which give respondents the total freedom to express themselves whilst the close-ended questions were that which restrict respondents in their response by providing a set of predetermined or coded answers for them to choose from. A bit freedom is, however, provided by occasionally asking respondents to specify or add their own response where applicable.

### **3.7 Data Collection Technique**

In collecting the data for the study, a self-administered questionnaire was developed and distributed to the respondents. However, in order to improve the response rate the researcher administered most of the questionnaires personally. The researcher gave adequate time to the respondents to fill the questionnaires independently. In all, the researcher gave each respondent a maximum of 2 days to respond to the questionnaires. Several trips were therefore made to the study areas to collect the responded questionnaires personally by the researcher. In all a total of 45 questionnaires were sent out but 41 was returned, putting the response rate at 91.1% were returned completed.

### **3.8 Ethical consideration**

In order to abide by the ethics of research, the study took ethical issues into consideration. In order to assure respondents of anonymity, names were not required on the questionnaires. It was also done in order not to match responses to the actual persons. Respondents were however assured of their confidentiality, privacy and consent. That was in the preamble of the questionnaire. Respondents were given that assurance that the information would only be for academic purposes. Attached to the questionnaire was a

form seeking the consent of the respondents that they could stop or withdraw at any time they feel and they were not under any obligation. Even before a respondent is given a questionnaire, his consent is sought before answering the questionnaire.

### **3.9 Data Analysis Procedure**

The primary data resulting from the survey were analyzed using both descriptive and inferential statistics. The data were screened for incomplete entries. With this, questionnaires which were not filled at all or had about 80% of their questions not responded to or answered were taken out of the dataset. The numbers that were assigned to the responses under the closed ended questions were retained as codes for data entries. On the other hand, the responses from the open ended questions were grouped based on their meanings and were also coded to facilitate data entry. The appropriate statistical tools were applied to the data based on the objectives of the study. The results were analyzed using SPSS, Frequencies; and Percentages were then generated.

The logo of Kenya Methodist University (KNUST) is a large, faint watermark in the background. It features a central shield with a yellow eagle with spread wings, a green base, and a red cross. Above the shield is a red flame-like shape. Below the shield is a yellow banner with the text 'NYANSAPU WJ SANE NO BADWENMA' in black capital letters.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSIONS**

#### **4.1 Introduction**

This chapter presented the results and discussion of data obtained from the study. The presentation of the results commensurate with the order of arrangement in which the objectives of the study had been. However the first part dwelt on the biographic information of respondents and rest of the results and discussion were presented under



themes in accordance with the objectives formulated for the study. The results obtained are actually in frequencies, charts and cross tabulations.

#### 4.2 Demographic characteristic of the respondents

In Table 1, the biographic information of the respondents were presented. It was realised that males were more than the females. About 95.1% of the respondents were males while 4.5% were females. It was again found that generally, respondents were well educated with majority (37.4%) having their degrees. Again, 19.5% had diploma while, 17.1% of the respondents had their master's degrees. Only 7.3% of the respondent did not state their level of education. On the qualification levels of respondents, 53.7% respondents were Contractor and 24.4% were also Quantity Surveyors. Seven respondents representing 17.1% were Architects and just 4.9% of the respondents were found to be Civil Engineers. Moreover, for the work experience or length of stay in the industry, majority of the respondents had worked for 1 to 5 years in the construction industry. It was also seen that 34.1% of respondents had stayed in the industry for between 6 to 10 years and only 7.3% of the entire respondents had worked for over 10 years in the construction industry.

**Table 1: Biographic information of respondents**

Characteristics		Frequency	Percentage
Gender	Male	39	95.1
	Female	2	4.5
Profession	Diploma	8	19.5
	Degree	23	56.1
	Master's	7	17.1
	Other	3	7.3
Level of qualification	Architect	7	17.1
	Civil Engineer	2	4.9

	Quantity surveyor	10	24.4
	Contractor	22	53.7
Work experience	<1 year	0	0.0
	1-5 years	24	58.5
	6-10 years	14	34.1
	10 and above	3	7.3

#### 4.3 Ghanaian contractors' level of awareness on sustainable building construction

Here the study sought to test the awareness level and understating of respondents on the subject matter. Results on Table 2 present the various definition of sustainable building construction by respondents. It was realized that most of the respondents (21.9%) stated that sustainable construction was the process that is environmentally approachable and resource effectual across the building's life-cycle. Again, seven respondents representing 17.1% indicated that sustainable project were those processes that include the impact the projects have on the environment. Six respondents each representing 14.6% explained that sustainable building projects were having designs that aim at providing long lasting, healthy and useful buildings and also those processes in construction that make efficient use of local materials. Moreover, 7.3% of the respondents said that sustainable building were those ways for buildings to produce their own energy and installing water and other ways to recycle waste. Similarly, 7.3% of the respondents recounted that sustainable projects were any action that considers social, economic and environmental impact.

**Table 2: Understanding of sustainable construction**

Responses	Frequency	Percent
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Any action that considers social, economic and environmental impact	3	7.3
Designs aimed at providing long lasting, healthy and useful building	6	14.6
involves environmental and resource efficient throughout a building's life cycle	5	12.2
Process of construction that make use efficient use of local resources	6	14.6
Process that includes the impact of the environment into consideration	7	17.1
Process that is environmentally approachable and resource effectual across the building's life-cycle.	11	21.9
Ways for buildings to produce their own energy and installing water and other ways to recycle waste	3	7.3
<b>Total</b>	<b>41</b>	<b>100.0</b>

Table 3 assesses the knowledge level of respondents as far as sustainable building projects are concerned. Moreover, this was done on a level of certain issues. For instance on the issue where sustainable construction seeks to eliminate or minimize impact of its footprints on the environment, majority (53.7%) agree that indeed that was in essence the imports of sustainable construction and 34.1% also strongly agreed that sustainable constructions seek to minimize impact on the environments. However, 12.2% of the respondents disagreed sustainable minimizes impacts on the environment. Moreover, 48.8% and 43.9% respectively mentioned that sustainable building construction promote sustainability of the built environment. Only 7.3% of the entire respondent said they were not sure on this issue. Adding to the above whereas 31.7% of the respondents said they were not sure sustainable construction were time-tested, practical and intuitive approach environmentally sound building. But respectively, 29.3% and 39.0% agreed and strongly agreed that sustainable constructions were time-tested, practical and intuitive approach to creating sound building.

Furthermore, majority of the entire respondents explained that sustainable building construction was design and habits that advance commercial condition and well-being of families. Again, with exception of 14.6% who were indifferent that sustainable constructions were necessary and should be encouraged, all the respondents agreed (58.5% strongly agree and 26.8% agreed) that sustainable constructions were necessary and should be encouraged. Moreover, nearly two thirds of the entire (70.7%) respondents indicated that integrating sustainability in the designs and constructions of new and existing buildings results in more efficient use of natural and financial resources.

**Table 3: Knowledge of sustainable building construction**

Variable	Frequency and Percentage					Rank
	SD	D	N	A	SA	
Seeks to minimize impact on the environment	0(0.0%)	8(12.2%)	0(0.0%)	22(53.7%)	14(34.1%)	4.24
Promote sustainability of the built env't	0(0.0%)	0(0.0%)	3(7.3%)	20(48.8%)	18(43.9%)	4.29
Time-tested, practical and intuitive approach	0(0.0%)	0(0.0%)	13(31.7%)	12(29.3%)	16(39.0%)	4.07



Promote economic health and well being	0(0.0%)	0(0.0%)	6(14.6%)	24(58.5%)	11(26.8%)	4.12
It is a necessity	0(0.0%)	0(0.0%)	6(14.6%)	11(26.8%)	24(58.5%)	4.44
It is efficient use of natural resources	0(0.0%)	0(0.0%)	0(0.0%)	12(29.3%)	29(70.7%)	4.71

Table 5 moreover, examines the various ways contractors understand how this sustainable constructions are done. According to results on table 5 more than two thirds of the respondents said installing energy efficient fixtures was the simplest way to reduce water waste. Again while most of the respondents mentioned that installing water efficient fixtures was the simplest way to reduce energy waste. Again while most of the respondents (39.0%) claim that recycling and re-using of building materials could be adopted, a significant proportion of the respondents disagreed and 31.7% were indifferent or simply not sure. In addition, majority of the respondents said optimizing the use of natural day light to lit the interior and reduce the use of energy must be apriority.

Twenty respondents representing 48.8% and 19.5% of the respondents strongly agreed and agreed that using natural ventilation must be used to deal with the problem of high room temperatures. Butt 14.6% of the entire respondents entirely disagreed with that view of using natural ventilation. Again, close to half of the entire (48.7%) respondents disagreed that using solar energy and other sources of energy were the cheaper and convenient than the hydro energy. Just 12.2% agreed to this effect that solar energy was cheaper and convenient than hydro energy. On the issue of using local materials for constructions, more than half (53.6%) disagreed that usage of local materials for constructions were not sustainable and 46.4% however agreed that local materials for contractions were not sustainable. Moreover, most of the respondents agreed that designs in constructions must

be aimed at reducing environmental over the project's life cycle and also the designs must not underestimates the safety and comfort of the occupants.

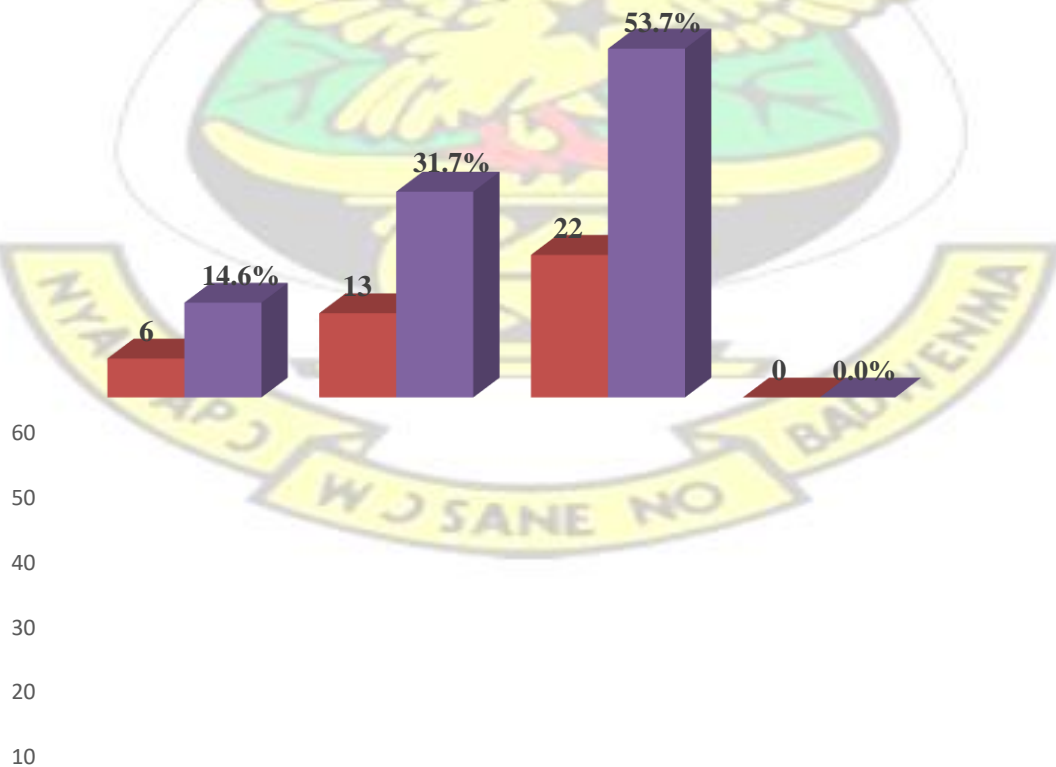
KNUST

**Table 5: Contractors understanding of the ways sustainable constructions are done**

Variable	Frequency and Percentage					Rank
	SD	D	N	A	SA	
Installation of energy efficient fixtures is the simplest way	0(0.0%)	0(0.0%)	0(0.0%)	35(85.5%)	6(14.6%)	4.15
Installation of water efficient fixtures is the simplest way	0(0.0%)	0(0.0%)	9(22.0%)	14(34.1%)	18(43.9%)	4.22
Recycle and reuse of building materials	6(14.6%)	6(14.6%)	13(31.7%)	3(7.3%)	13(31.7%)	3.27
Optimizing the use of natural daylight	0(0.0%)	0(0.0%)	3(7.3%)	27(65.9%)	20(48.8%)	5.29
Use natural ventilation to deal with the problem	0(0.0%)	6(14.6%)	7(17.1%)	8(19.5%)	20(48.8%)	4.02

Use solar and other energy sources	6(14.6%)	14(34.1%)	16(39.0%)	5(12.2%)	0(0.0%)	2.49
Local materials are not sustainable	11(26.8%)	11(26.8%)	0(0.0%)	19(46.4%)	0(0.0%)	2.66
Designs must aim at reducing env't impact	0(0.0%)	0(0.0%)	7(17.0%)	25(61.0%)	9(22.0%)	4.05
Safety of occupants are important	0(0.0%)	0(0.0%)	0(0.0%)	27(65.9%)	14(34.1%)	4.34

On figure 1 the study sought the views of respondents on when they think sustainable practice must be considered. According to the results most of the respondents stated that sustainability practices must be considered at the activity planning stage. Thirteen respondents representing 31.7% mentioned the design stage and 14.6% said it should be considered at the construction stage.



Construction Design stage    Activities stage    Finishing stage stage

■ Frequency    ■ Percent

**Figure 1: Stage at which sustainable practices are considered**

#### 4.4 Barriers to sustainable building practices

Table 6 examined the views of respondents on the barriers to sustainable building constructions and on the issue of higher initial cost, only 7.3% of the respondents stayed indifferent all of the entire respondents agreed that initial cost is one of the greatest obstacle to sustainable building. For lack of research interest, majority of the respondents (78.1%) agreed that it was actually a problem for sustainable building. Again more than half of the respondents (53.7%) agree that the growing lack of experienced workforce was also a barrier. Majority of the respondent were indifferent when it come to the issue of risk and uncertainty as an obstacle and about 27% agree that risk and uncertainties were problem. Moreover, whereas about 74% of the respondents disagreed that sustainable constructions were not profitable, 26% agree that it was not a profitable venture. While 78.0% respondents said the lack of coordination in government policies, 36.6% of the respondents mentioned the uncertainty of funding agencies to sponsor projects were problem.

**Table 5: Barriers to sustainable building practices**

Variable	Frequency and Percentage					Rank
	SD	D	N	A	SA	
Higher initial cost	0(0.0%)	0(0.0%)	3(7.3%)	20(48.8%)	18(43.9%)	4.37
Lack of research interest	0(0.0%)	0(0.0%)	9(22.0%)	27(65.9%)	5(12.2%)	3.90



Lack of experienced workforce	0(0.0%)	6(14.6%)	13(31.7%)	22(53.7%)	0(0.0%)	3.39
Risk and uncertainty	0(0.0%)	9(22.0%)	21(51.2%)	11(26.8%)	0(0.0%)	3.05
They are not profitable	8(19.5%)	22(53.7%)	0(0.0%)	6(14.6%)	5(12.2%)	2.46
High perceived cost	0(0.0%)	3(7.3%)	16(39.0%)	22(53.7%)	0(0.0%)	3.46
Funding entities are less likely to sponsor	7(17.0%)	5(12.2%)	15(36.6%)	9(22.0%)	5(12.2%)	2.80
Lack coordination in government policies	0(0.0%)	0(0.0%)	3(7.4%)	32(78.0%)	6(14.6%)	4.07

On table 6, the study assessed the issue of lack of research interest in the light of education. The results proved that the two variable were associated and that the level of education of the respondents could spur the building of sustainable projects. With a chisquare ( $\chi^2$ ) of value of 38.76 and a probability value of 0.00, it means at 1% level of significance, research interest and the level of education were related. This revelation was confirmed when most of the respondents (65.9%) who agreed were respondents with degree and master's degree.

**Table 6: Cross tabulation of lack of research interest and level of education**

Lack of research interest	Level of education				Total
	Diploma	Degree	Master's	Other	
	F (%)	F (%)	F (%)	F (%)	F (%)

Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Neutral	8 (19.5)	0 (0.0)	1(2.4)	0 (0.0)	9(22.0)
Agree	0 (0.0)	18(43.9)	6 (14.6)	3 (7.3)	27(65.9)
Strongly agree	0 (0.0)	5 (12.2)	0(0.0)	0 (0.0)	5(12.1)
Total	8(19.5)	23(56.1)	7(17.1)	3 (7.3)	41(100.0)

$\chi^2 = 38.76$  p-value = 0.000

Table 8 also performed a similar exercise as the previous table (table 7), however it look at work experience and lack of coordination in polices. Generally it requires someone to stay in a certain business to detect some inconsistencies or otherwise. This view was also proven to be true with the test of association being significant at 1% level of significance. Again, the responses indicated that 78.0% of the respondent who agreed that there lack of coordination in the policy direction were people who had more one year experience (43.9% had 1-5 years and 34.1% had 6-10 years).

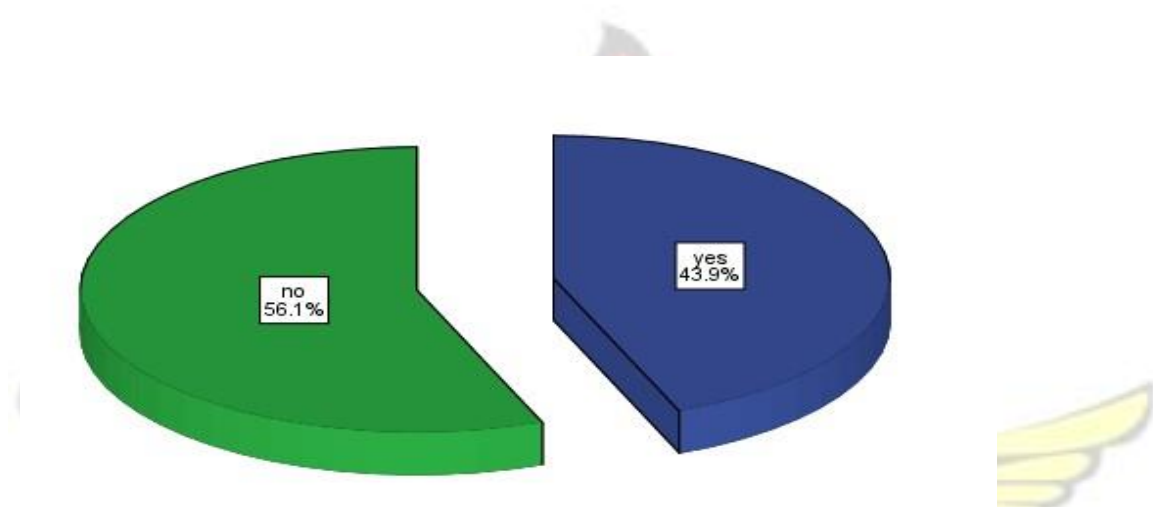
**Table 7: Work experience and the lack of coordination in the government policies.**

Lack of coordination in government policies	Work experience in the industry				Total
	<1year	1-5 years	6-10years	>10 years	
	F (%)	F (%)	F (%)	F (%)	F (%)
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Neutral	0 (0.0)	0 (0.0)	0(0.0)	3 (7.3)	3(7.3)
Agree	0 (0.0)	18(43.9)	14(34.1)	0(0.0)	32(78.0)
Strongly agree	0 (0.0)	6(14.6)	0(0.0)	0 (0.0)	6(14.6)
Total	0(0.0)	24(58.5)	14(34.1)	3 (7.3)	41(100.0)

$\chi^2 = 45.48$  p-value = 0.000

#### 4.5 Availability of Government Programmes

On the availability of policy framework towards sustainable development, majority (56.1%) of the respondents said there were no or they were not aware of any policy framework and programmes towards sustainable development. However, 43.9% of the respondents said they were aware of the framework or policy towards sustainable development



**Figure 2: Awareness of policy framework and programmes towards sustainable projects**

Results on table 9 follows were a follow-up to the results on figure 2. Here the study tried to identify if there were government policies in place also towards sustainable construction practices in the country. According to the results, more than half of the entire respondents (56.1%) said there no government policies, while 43.9% said there were government policies towards achieving sustainable building practices in Ghana. In addition to that on the same table, respondents were asked to name or mention of the government policies or frameworks if in deed there were something like that in the system. Out of the 43.9% who said there were policies like that, 17.1% mentioned that there were actually policies such that the building materials must be locally manufactured. Six respondents representing

14.6% said that there were also policies that government have actions help people to make use of solar energy and 12.2% of the respondents said the country has policies that any procurement in the building industry goes through the public procurement system.

**Table 9: Knowledge of government policy towards sustainable building**

Responses	Frequency	Percent
<b>Knowledge of government policy towards sustainable building</b>		
Yes	18	43.9
No	23	56.1
Total	41	100.0
<b>Some of the policies</b>		
Action to make use of solar energy	6	14.6
Building materials must be locally manufactured	7	17.1
Public procurement system	5	12.2
Total	18	43.9

From table 10 respondents who responded affirmatively that there were policies and even went ahead to name some of them were asked whether those policies encourage sustainable building and as such encourages people to adopt a more environmentally responsible construction practices. While only 29.3% said yes, most of the entire respondents (36.6%) said they not sure and 34.1% mentioned that those policies were not good and as such do not encourage the adoption of environmentally responsible construction practices.

**Table 10: Policies encourage sustainable building**

Responses	Frequency	Percent
Yes	12	29.3
No	14	34.1
Not sure	15	36.6



Total	41	100.0
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## 4.6 Discussion of the results

### 4.6.1 Contractors' level of awareness on sustainable building construction

On the level of knowledge of respondents or contractors, it was reveal that most of the contractors were knowledgeable on the subject matter and this was in relation to the similarity of views sheared. For instance on table 2 where respondents were asked to explain what sustainable construction was, it was clear that most of the respondents said sustainable building were those designs that takes the impact of the project or the building on the environment into consideration. Others also said sustainable building were the process that is environmentally approachable and resource effectual across the building's life-cycle; and some echoing that they were designs that are aimed at providing long lasting and healthy building. From those definition one cannot draw a line between them, the only difference is a matter of semantics and one thing was common in that the building should be environmentally friendly and that some amount of the locally manufactured materials must be used. These views very much support the definition of Robichaud and Anantatmula (2011), that 'sustainable construction were those philosophies and associated projects and construction management practices that seek to minimize or eliminate impacts on the environment, natural resources, and non-renewable energy sources to promote the sustainability of the built environment; enhance the health, wellbeing and productivity of occupants and whole communities; cultivate economic development and financial returns for developers and whole communities'.

Moreover on the knowledge levels of respondents as seen on table 3, most of the respondent agreed that sustainable building were processes that minimizes environmental

impact, they time tested and practical approaches and designs that promote the wellbeing of occupants. This assertion was also consistent with the studies of Coventry and Woolveridge (2002); and Venables et al. (2000). Coventry and Woolveridge (2002) clarified ‘that the aim of sustainable assembly was to craft and work a healthy crafted nature established on resource efficiency and ecological design alongside an emphasis on seven core principles across the building’s existence cycle: cutting resource consumption, reusing resources, employing recyclable resources, protecting nature, removing toxics, requesting existence series costing, and concentrating on quality’.

Again, Kibert (2008) added ‘that sustainable assembly were those habits that include: rising efficiencies, thereby saving power, water, and supplementary resources; and employing environmentally preferable material. Furthermore on the approaches of carrying out these practices, most of the respondents agreed that contractors install energy efficient fixtures, recycle and reuse building materials, optimize the natural daylight and moreover, apply natural ventilation to deal with the problem of high room temperatures. According to UNEP (2011); and Hill and Bowen, (1997), green building designs or sustainable constructions are those design strategies that take advantage of the characteristics of the building site, insolation, microclimate, and other factors to meet lighting, heating and cooling needs. For example, natural ventilation and day lighting improves the building occupants’ health and well-being without the use of active technology.

#### **4.6.2 Barriers to sustainable building practices**

On the barriers to sustainable building projects, majority of the respondents again, agree that there high initial costs, the lack of research interest, lack of experienced workforce and lack of coordination and consistency in the government policies. In deed the view that

the lack of research interest was a barrier was not a departure for the study of (Fieldson, 2007). Fieldson (2007) explained that if contractors seek to fully understand the issues from the viewpoint of all of the stakeholders and the challenges they face it becomes easier to have successful outcomes. Stang and Hawthorne (2005) posit that a major obstacle to sustainable design was that there were architects who are not distressed alongside green design as they trust that power efficiency and architectural aesthetic are two contradictory agents and are watchful that the label of green architect could alter their area perception. Moreover, Langdon (2007), argued that barriers to sustainable building comprise: steep industry learning curve - general lack of knowledge about the economic and environmental benefits of high performance buildings; and fiscal consideration – uncertainties on the rate of return or pay back of investments and other monetary consideration. Again, in the survey of World Business Council (2007), it was seen that one major price barrier was the uncertainty that developers, real land professionals, and a little capital providers have concerning green building. In the same survey, was revealed that higher initial or actual cost of most sustainable projects (green designs) were relatively high. Gazeley (2008) stated categorically clear that a building's early assembly prices normally could embody merely 20 to 30 percent of the building's whole prices above its functional existence, underscoring the demand to ponder not just the early price of the constructing but additionally the year-to-year working costs; additionally, proprietors of investment property normally assess assembly and working prices above a grasping era of ten years or fewer. It was seen on table 3 that majority of the respondents (53.7%) lamented the rising number of inexperienced workforce in the area of sustainable or green projects though a significant percentage of the respondents (31.75%) were not sure how this could be a problem. The opinion of the majority group was vindicated by the study of (Guy and Moore, 2005). Guy and Moore (2005) bemoaned the setback of the privation of

knowledgeable operatives and therefore rising the chance of inexperienced or untrained ability providers going in the green constructing marketplace in find of a premium on their services. Kibert (2005) again added that the expansion of green or sustainable project s hinges on the consistency and coordination in policy frameworks. The study mentioned for example inconsistencies in building codes hamper the operation of different building resources and advanced strategies in the design.

On table 6 and 7 the chi-square test of association also confirmed the agreements afore mentioned. It states that at 1% level of significance, level of education of contractor and research interest were related. Again, experience in the industry and policy coordination were also related or associated at 1% significance level. Meaning that the higher the number of years in the industry one is able to know the level of inconsistencies in the policy frameworks provided. US Green Building Council (2007) stated that in the USA only an average of \$193 million per year between year 2002 and 2005 were allocated to green project/construction research and this signifies just 0.02% of the projected yearly worth of U.S building construction industry.

#### **4.6.3 Availability of Government Programmes**

For the availability of policy frameworks and government policy/programmes towards sustainable contractions, it was observed that less that 50% of the entire respondents said either there were no policy framework and governments policy on sustainable project or they were not aware of any government policy like that in the country. According Asaase (2012) citing Osae-Akonnor (2012) there are actually policies like that about green building in Ghana. The report stated that there is even the Ghana Green Building Council



(GGBC) established in 2009 with the mission to transform the built environment in Ghana towards sustainability through the way communities are planned, designed, constructed, operated and maintained. The GGBC has some mandate to: campaign the actions by government, industry and any other body who has a role to play in delivering sustainability in the built environment; establish policy regarding green building for Ghana; influence others to support the construction of green buildings in Ghana; encourage public-private partnerships to further facilitate the uptake of green buildings; and influence stakeholders to support the construction of green buildings.

Moreover, According Asaase (2012) the council has in the time past collaborated with the ministries and organisations like the Ministry of Environment Science and Technology, Ministry of Local Government and Rural Development, Ministry of Water Resources Works and Housing among other department and Agencies, Institutions of Higher Learning and Organizations. Asaase (2012) also report that there was launch of the Ghana framework which seeks to create a platform, provide inspiration and contribute to national development on how we plan, design, construct, operate and maintain and renew sustainable communities in Ghana.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter presents the summary and the major findings of the study, the conclusions drawn from the study and the recommendations made.

#### **5.2 Summary**

The purpose of the study was to investigate sustainable building construction practices of Ghanaian building contractors. A descriptive survey design was used for the study and it was because this design facilitated a systematic description of respondents view and experiences with the construction industry. The study used set of questionnaires to illicit or collect information from the respondents. Again, the study simply used charts, frequencies and cross tabulation to analyse the data and employed the use of chi-square test to test for statistical significance of association.

The study revealed by most of the respondents that sustainable construction was the process that is environmentally friendly and resource efficient throughout the project's life-cycle while considerable proportion of the respondents explained sustainable project to include those processes that considers the impact the projects has on the environment. It was also found that the general knowledge of respondents on sustainable building in terms of the various definitions given were high.

Moreover, in respect to the understanding of respondents on various issues of green projects or sustainable building, about 87% of the entire respondents agreed that seeks to

minimize or eliminate impact on the environment. Again, about 92% of the respondent stated that sustainable building promote sustainability of the built environment. Similarly, respondent agreed that sustainable building was an efficient use of natural and financial resources.

The study also revealed by most of the respondents (85.5%) that the installation of energy efficient fixtures was the simplest way to reduce energy wastes, and the found that 65.9% of the respondents maintained that as one advantage of green building was ensuring the comfort and safety of the occupants of the building. Respondents claimed that sustainable processes must be considered at the activity stage of construction projects.

On the barriers to sustainable building practices, respondents agreed that high start-up cost and the actual building cost were some of the barriers to sustainable practices. There were also mention of the lack of experienced workforce and lack of research interest. It was also found by most of the respondents that absence of direction and uniformity in government strategy frameworks hinder the development of sustainable building constructions.

For the area of government policy availability most of the respondents (56.1%) said they were no aware of any such government policy on sustainable building in Ghana. Even those respondents who said they aware most of them (36.6%) maintained they were not sure those policies encourage people to adopt more environmentally responsible construction practices.

### **5.3 Conclusions**

The aim of the study was to investigate sustainable building construction practices of Ghanaian building contractors. It was evident from the study that sustainable building in Ghana was not something new per the views expressed and the definitions given. It could be concluded that respondents have a fair idea or knowledge in sustainable construction.

This is portrayed by the similarity of view expresses by respondent. For instance on the definition of sustainable construction, most of the respondents maintain were designs or process that were environmentally friendly.

Moreover, respondents made it that having efficient fixtures in place was one way of getting sustainable projects done. Other respondents stated the importance of harnessing natural sunlight and ventilation to produce energy and regulate room temperatures. Above all majority of the respondents rehashed that sustainable construction must sure the safety and comfort of various occupants upheld.

The study found that there were barriers to smooth progression of sustainable building projects. It was seen that high initial costs, high actual costs of projects, lack of research interests, lack of experienced workforce, risks and uncertainties and lack of coordination and consistencies in the policy direction of government if there were any. In fact the chisquare test of association highlighted the enormity of these barriers. Especially respondents who had been in the construction industry for well over 5 years confirmed that the inconsistency in policy frame works were of essence. Nonetheless, respondents with higher level of education like the masters, also supported the view that the research interest in green projects or sustainable building were lacking.

The study revealed that there were great concerns on the availability of frameworks and government policies/programmes to achieving sustainable building constructions. Results from the table showed that majority of the respondents (56.1%) said there were no or they were not aware of any policy framework and programme towards sustainable development in the country. Even the 43.9% who said there were policies like that, over two thirds of them mentioned that they were not sure those polices were not good and as such do not encourage the adoption of environmentally responsible construction practices.



## 5.4 Recommendations

Based on the findings and conclusion the following recommendations were made:

1. It is recommend that the Ghana Green Building Council do more in the dissemination and educating Ghanaian contractors in the area of sustainable building projects. This is because the backdrop of majority of the respondents not being aware of certain frameworks on sustainable building project in the country.
2. The study also recommend that government work in collaboration with all other stakeholders so as to put in place a very good and formidable policy framework that is all encompassing. This would make contractor adopt a more responsible construction practices.
3. It is also recommended that there should be more public education and awareness of the advantages of sustainable building in Ghana so many people can understand and appreciate green design and also clear the negative perceptions people.
4. It is also recommended that contractors in sustainable buildings should give preference to the safety and comfort of the occupants.

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## APPENDIX I

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**COLLEGE OF ARCHITECTURE AND PLANNING**

## DEPARTMENT OF BUILDING TECHNOLOGY

This questionnaire is part of a research study to investigate “Sustainable Building Construction Practices of Ghanaian Building Contractors in partial fulfillment for the award of Master’s Degree in Construction Management.

Please you are therefore assured of absolute confidentiality, hence do not provide your name on the script.

**Instructions:** Please choose your answers from the options provided or provide your own answer in the spaces provided if required. Thank you.

### Section A: PERSONAL INFORMATION

1. Gender:      i. Male ☐                      ii. Female      ☐
2. Level of qualification?
  - a)      Architect      ☐                      b) Civil Engineer      ☐                      Quantity Surveyor ☐
  - d)      Others (Please specify).....
3. What is your level of education?
  - ☐ a)      Diploma                      b)      Degree                      ☐
  - ☐      Masters Degree                      ☐
  - d)                      PhD      e) Others (Please specify).....
4. How long have you been working in the Construction Industry/Firm?
  - a)      Below one year                      b) One-Five years      ☐                      c) 6-10 years      ☐
  - ☐                      ☐
  - d) 10 years and above ☐

## Section B: LEVEL OF AWARENESS OF GREEN CONSTRUCTION

5. What is your understanding of Sustainable Construction?

.....

.....

.....

6. How did you acquire the knowledge on sustainable building?

- (a) Through education/school ☐ (b) from the job experience ☐
- c) through the media ☐ (d) Seminar ☐ (e) trade fair/housing fair ☐
- Other, please specify.....

7. On a scale of 1-5, show your agreement or otherwise to the statements below by ticking your preferred option.

**1-Strongly Disagree** **2-Disagree** **3-Neither agree nor disagree** **4-Agree**  
**5-Strongly agree**

No	Statement	1	2	3	4	5
i.	Sustainable Construction seek to minimize or eliminate impacts on the environment					
ii.	Sustainable Construction promote the sustainability of the built environment					
iii.	Sustainable Construction is a time-tested, practical and intuitive approach to creating environmentally sound buildings					
iv.	Sustainable Construction is a design and construction practice that promotes the economic health and well-being of the family					
v.	Sustainable Construction is a necessity and should be encouraged					
vi.	Integrating sustainability in the design and construction of new and existing buildings results in more efficient use of natural and financial resources					

8. Do you consider your designs as sustainable (concerning resources of material and energy by using durable, recyclable, and renewable materials)?

- a) Yes ☐ (b) No ☐ c) Not Sure ☐

d) Others (Please specify).....

9. Give reasons:

.....

.....

.....

10. On a scale of 1-5, show your agreement or otherwise to the statements below by ticking your preferred option.

**1-Strongly Disagree 2-Disagree 3-Neither agree nor disagree 4-Agree 5-Strongly agree**

NO.	Statement	1	2	3	4	5
i.	Efficient energy usage through installation of energy efficient fixtures is the simplest way to reduce energy waste					
ii.	Efficient water usage through installation of water efficient fixtures is the simplest way to reduce water waste					
iii.	Recycle and re-use of building materials can be adopted and practice in Ghana without any difficulties					
iv.	Optimizing the use of natural daylight to lit interior and reduce the use of energy must be a priority during design stage					
v.	Natural ventilation to deal with the problem of heating must not be an afterthought					
vi.	Solar and other energy source is cheaper and convenient than hydro					
vii.	The use of local material for construction is not sustainable					
viii.	Design and construction must aimed at reducing the environmental impact of a building over it entire lifetime					
ix.	The comfort and safety of occupant must not be underestimate during design stage					

11. At what stage in the construction process must sustainable practices be considered?

- a) Construction Stage      b) Design Stage      c) Activities
- Planning Stage [ ]      d) Finishing Stage [ ]
- e) Others (Please Specify ).....



### **Section C: PRIMARY BARRIERS TO SUSTAINABLE BUILDING PRACTICE**

12. In your own opinion do you think one needs special knowledge and training in the Construction of sustainable building?

- a) Yes ☐      b) No. ☐

13. What other alternative energy source do you adopt in your design scheme?

- a) Generator (plant) ☐      b) Solar ☐      c) Windmills ☐  
d) Biogas ☐      e) None ☐      f) Others (Please specify) .....

14. On a scale of 1-5, show your agreement or otherwise with the statements below regarding the barrier to sustainable building.

***1-Strongly Disagree      2-Disagree      3-Neither agree nor disagree      4-Agree      5-Strongly agree***

<b>Statement</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Higher initial costs as the greatest obstacle to sustainable building					
Lack of research interest is a major barrier to sustainable building					
Lack of Experienced Workforce is a barrier					
Risk and Uncertainty is a major barrier to sustainable building					
Sustainable building is not a profitable venture					
Higher perceived or actual first costs of many green building strategies and technologies are a significant disincentive					
Government agencies and funding entities are less likely to sponsor sustainable buildings					
Lack of coordination and consistency in government policies can act as a barrier to green building					

### **Section D: AVAILABILITY OF GOVERNMENT PROGRAMMES TO ENSURE**

## **SUSTAINABLE BUILDING PROJECTS**

15. Are you aware of any policy framework and programme towards sustainable development?

a) Yes ☐ b) No. ☐

16. Do you know of any Government policy or programme towards achieving sustainable construction Practices in Ghana?

a) Yes ☐ b) No. ☐

17. Mention some of such policies or programmes you know of

.....  
.....  
.....

18. In your own opinion do these policies encourage sustainable building?

a) Yes ☐ b) No. ☐ c) Not Sure ☐

19. Do you feel by these policies and programmes to adopt more environmentally responsible sustainable construction practices?

a) Yes ☐ b) No. ☐ c) Not Sure ☐