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DEPARTMENT OF BUILDING TECHNOLOGY

A Framework for The Implementation of Green Certification of Buildings in Ghana

By

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DECLARATION

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

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ABSTRACT

Buildings are responsible for more than 40% of global energy use and one third of global greenhouse gas emissions both in developed and developing countries. A number of buildings are constructed every year but only a small number of them can be identified as "green buildings." Despite the well-known benefits of green certification of buildings, it still remains in the state of infancy in Ghana, and adequate diffusion and implementation strategies should be put in place to ensure that they become more established. This study therefore sought to propose a framework which has guidelines which are practical steps that can aid the certifying body in making decisions in relation to implementing the green certification of buildings. Roger's diffusion of innovation theory and Hartman's theory were adopted to aid in proposing a framework. The study adopted a qualitative method of enquiry with semi-structured interviews to gather data from professional bodies in the built environment. Findings from the study revealed that some of the professional bodies have used their influences to sensitize their members on green certification of buildings while others are yet to do the same. The key barriers to the adoption of green certification of buildings were identified to include lack of legal backing, cost and financing, inadequate awareness of the benefits of green certification of buildings, inadequate human resources, lack of active government participation, and the conservative nature of Ghanaians. Furthermore, the main drivers for the adoption of green certification of buildings were also identified to include lack of observability of the benefits of green certified buildings, commitment of government, incorporating it into the code of practice for professional bodies, public acknowledgement, policies and regulations, effective communication and source of information. To ensure that green certification of building is implemented in Ghana, it is recommended that the guidelines in the

proposed framework must be adopted by the certifying body which would help increase the awareness and adoption of green certification of buildings in Ghana.

Keywords: Green certification, drivers, barriers and Implementation framework

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DEDICATION

This thesis is dedicated to Almighty God.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The increasing preoccupation with the availability of natural resources and the way they are used by the society, particularly the construction industry, have prompted the need to introduce and apply sustainable concepts (Brundtland, 1987). The number of buildings produced every year results in a huge impact on the consumption of natural resources. However, only a small number of these buildings can be identified as 'green buildings' (Seyfang, 2010; Smith, 2007). The construction sector has been accused of its excessive consumption of material resources because of the use of non-sustainable materials, with high values of embodied energy (Tau et al., 2011; Shen *et al*., 2002). Therefore, since over 80% of people's time is spent inside buildings (Amado, 2001) it makes the construction sector the ideal vehicle to introduce sustainable guidelines of development, given that resource savings can be achieved (Lucas and Amado, 2012). Korkmaz et al. (2009) reported that in the United States, buildings consume approximately 40% of all energy, 72% of all electricity and produce 39% of primary greenhouse gas emissions. China consumes 40% of the world's cement and steel every year on the total floor areas of new buildings due to its fast economic development and urbanization (Qui, 2010). Adegbile (2013) asserts that due to increase in technological advancement and economic growth, building construction has greatly increased and has accounted for almost half of the greenhouse gas emissions and energy consumed due to the energy used in the production and transportation of materials. Brundtland (1987) also attributed the excessive consumption of energy and water to the needs of people in terms of comfort and quality of life of modern society. Many buildings disregard the needs required by

users, such as level of thermal comfort, acoustic comfort, ventilation and indoor air quality, leading to unbearable energy costs over the long term (Tau *et al.*, 2011). Therefore, there is the need to reverse this trend and promote practises that seek to maintain the remaining resources in order to sustain the human race.

1.2 PROBLEM STATEMENT

In comparison to conventional buildings, studies have shown that green buildings have prolong lifecycles, lower cost of maintenance and operational costs, reduced water and energy bills and can attract higher rents, and experience reduced turnover (BC1 Economics, 2014; Deng and Wu, 2013; Jensen, 2011; Say and Wood, 2008; Sangster, 2006). In a typical office building for instance, energy represents about 30% of operating expenses which directly affects tenants and building owners (Eichholtz and Quiley, 2010). Thus the onus lies on the design, construction and operation of buildings to play an important role in energy conservation.

Ghana can only boast of 6 green buildings since its introduction by the Ghana Green Building Council in 2009. These buildings are: One Airport Square (Green Star South Africa-Ghana), Stanbic Heights (Green Star South Africa-Ghana), Ridge Hospital (LEED), World Bank Building (LEED), United Nations Building UK, Baby and Mother Unit at Komfo Anokye Teaching Hospital (Edge Certification). United Kingdom records over 115,000 certified green buildings with additional 700,000 registered for eventual certification (Ozolins, 2010), Canada records over 480 certified green buildings (Redl, 2013), Australia records over 148 certified buildings (Ozolins, 2010) and South Africa records about 50 green buildings (Rogerson, 2014). A major strength of countries recording high numbers of green buildings is that they have green building certification systems which are very effective, with backing from their

governments. Currently in Ghana, the green building certification system (Green Star Sa-Ghana) which directly promotes green buildings is a voluntary compliance with standards promulgated by a private organisation (Patricia, 2005), i.e. the Ghana Green Building Council (GhGBC) with inadequate governmental support. Green Building Councils (GBCs) and green building certification systems function as indicators of a country's green building status and proficiency. This is evident in countries with well-established GBCs and certification systems as they are the world's most advanced green building nations compared to countries which do not have a vibrant GBCs and active certification systems (Sangster, 2006).

Despite the well-known benefits of green buildings, organizations fail to obtain anticipated benefits in technology innovation because they are unable to successfully manage the implementation of the required certification tools which is critical for continued success (Klein and Knight, 2005). According to Du Plessis (2007), sustainable/ green building is still at its infancy stage in developing countries, especially Africa because of the aforementioned problems. Studies conducted in Ghana so far indicate that green building is not extensively practiced (Bandome-Dery and Kootin-Sanwu, 2013). The question is 'how can green buildings be practiced if there is no effective certification tool in Ghana?'. Furthermore, how can it be practiced if the level of knowledge of the professionals directly involved in the certification process is unknown? Are there potential drivers for green certification of buildings at all in Ghana? If there are what are the potential barriers that are hindering the implementation of such certification systems? It is in the wake of these questions that this study has been conducted. As green certification of buildings still remains in its infancy, adequate diffusion and implementation strategies should better equip the general populace to embrace such systems.

1.3 AIM

The aim of this study is to propose a framework to enhance the implementation of green certification of buildings in Ghana. This framework would have guidelines which are practical steps that can aid the certifying body in making decisions in relation to implementing the green certification of buildings.

1.4 OBJECTIVES

The following objectives were set to help achieve the aim of the study:

1. To identify the level of knowledge of built environment professionals on green building certification in Ghana;
2. To identify the drivers of green certification of buildings in Ghana;
3. To identify the barriers to green certification of buildings in Ghana;
4. To propose a framework for the implementation of green certification of buildings.

1.5 SCOPE OF STUDY

Geographically, the research was undertaken in Ghana, which is situated in West Africa. The professional bodies used in this study are Ghana Institute of Architects (GIA), Ghana Institute of Construction (GIOC), Ghana Institute of Surveyors (GhIS), Ghana Green Building Council (GhGBC), Association of Building and Civil Engineering Contractors of Ghana (ABCECG), Chartered Institute of Builders (CIOB-Ghana), Institution of Engineering and Technology (IETG), Ghana Real Estate Developers Association (GREDA), Building and Road Research Institute (BRRI), and Ghana Institute of Planners. Rogers (2003) defined social system as a set of units that are interrelated and engages to solve a problem to accomplish a goal. These units may be individuals, organisations, informal groups associations or institutions. According

to Rogers (2003), a social system has a boundary within which an innovation can spread. These units in the social systems have norms which are the established behavioural patterns for the member (Rogers, 2003). These norms, code of practice or regulation serve as a guide for units of a social system. However, the norms of these systems can be a barrier to the green certification of buildings. Therefore, social system can help or prevent the diffusion of an innovation. This study identifies professional bodies in the built environment as a unit in a social system which has norms or regulation per Roger (2003) definition of a social system.

1.6 RESEARCH METHODOLOGY

In order to conduct a robust research, the study adopted the appropriate philosophical consideration such as ontology, epistemology and axiology. A comprehensive review of literature from sources such as books, journals, reports, conference proceedings and other publications regarding green building certification was conducted. Literature on various green building councils in some countries were reviewed to ascertain their compositions, duties and contributions made towards the growth of green building in such countries. Drivers and barriers were identified from literature in order to help the researcher understand the principles needed to develop the framework for green building certification. The barriers and drivers to green building certification were synthesized into the design and formulation of the framework. The review further revealed that Roger's Innovation Diffusion theory and Hartman's framework were suitable, and hence were chosen to propose a framework for the implementation of green certification of buildings suitable for Ghana.

A qualitative study was adopted which informed the use of interview guide in collecting data from the respondents. Purposive sampling was used in selecting the

professional bodies because there was not adequate information on all the professional bodies in Ghana. These professional bodies were selected based on previous research related to the current study and also because they have ability to either promote or frustrate the diffusion of an innovation like green certification of buildings. Letters were written to these professional bodies to nominate a representative who is knowledgeable on green certification of buildings to speak on their behalf. The selection criteria used included the following: The respondent had to be a member of a professional body, he/she had to be knowledge on the subject matter, he or she had to be willing to be interviewed and he/she had to be available for the interview. Ten (10) representatives from the professional bodies were interviewed on behalf of the various professional bodies. The interviews conducted were semi-structured based on an interview guide. Data was recorded electronically using an audio recorder and a notebook. The recorded interviews were transcribed using MS Word, 2016 version and analysed using the Nvivo software. The research methodology has been discussed in detail in Chapter 3 of this report.

1.7 SIGNIFICANCE OF STUDY

Green buildings have longer lifecycles, reduced maintenance and operational costs, lower water and energy bills and can attract higher rents, experience lesser turnover and have higher rates of occupants' satisfaction (BC1 Economics, 2014; Deng and Wu, 2013; Jensen, 2011; Say and Wood, 2008; Sangster, 2006). Also green buildings make economic sense on the life cycle basis. This is due to the use of sophisticated building and outdoor conditions (Kibert, 2004). Green buildings provide intangible benefits to occupants through improved comfort, health, productivity, among others.

Due to these benefits of green buildings, an implementation framework for green certification of buildings in Ghana must be adopted that will inevitably aid in achieving the above stated benefits. Therefore, this research proposes a framework which has guidelines that can aid the certifying body in making decisions in relation to how to promote the green certification of buildings. This framework will help in the implementation of green certification of buildings.

1.8 STRUCTURE OF THESIS

The research is structured into five (5) main chapters. Chapter one introduces the study, statement of the problem, aim, objectives, research scope, methodology, and significance of the study. Chapter two reviews literature on green buildings, green building councils and the various certifications systems, the role of governments in promoting green building certification and related frameworks to the subject of study has also been presented. Chapter 3 examines the research methodology used in achieving the aim and objectives. Chapter four presents and discusses the results obtained from the study, and Chapter five concludes the research conducted and gives recommendations based on the findings from the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents literature based on the various objectives of the study. It begins by reviewing literature on green buildings, green building certification systems and the various green building councils. Furthermore, the drivers and barriers to the adoption of green certification of buildings have been reviewed. Existing frameworks anticipated to aid in proposing a framework for green certification of buildings have also been reviewed.

2.2 GREEN BUILDING: BACKGROUND AND DEFINITIONS

The concept of green building was developed in the 1980's as a result of the alarming trends of climate change due to increase in the emissions of CO_2 and scarcity of resources (Redl, 2013). Green building as defined by Richardson and Lynes (2007) is a building which is resource and energy efficient, with less pollution into air, soil and water and is much healthier for occupants than conventional buldings. The words 'green' and 'sustainability' are most of the times used interchangeably. A certified green building is mostly used synonymously to "high-performance building", "environmental friendly building", "sustainable building" and "energy efficient buildings". Landman (1990) referred to sustainable buildings as "green" or "environmentally friendly buildings". Adegbile (2013) indicated that the aim of green building certification system is to develop criteria which would be used to rate a building in order to provide a score or a descriptive rating for that building. Gundogan (2012) identified another key element of green buildings as the certification systems

or assessment systems or rating tools used to examine the performance of a building and to improve the green building process and strategies.

2.3 BENEFITS OF GREEN BUILDING

Expected output of a green construction is that throughout the building's lifetime, it uses less water, produce less waste and create a healthy environment for its inhabitants and surrounding community (Colliver, 2007; Owens and Halfcre-Hitchbook, 2006). Jensen (2011) indicated that green buildings use fewer resources for their operations than the traditional buildings. Green building incorporates sustainable features from the energy modelling, resource reuse, material sourcing and civic amenities (Fazli and Faridi, 2011). Saraswat and Shukul (2015) further added that such buildings decrease the extent of energy needed for cooling, heating and lighting by using unreceptive tactics such as day lighting, shading using sunlight through passive solar and photovoltaic methods and using plants and trees during green roofs. Green constructions further lessen the amount of water needed for non-consumption practices through the installation of water conserving fixtures and trough rainwater harvesting systems.

2.4 GREEN BUILDING CERTIFICATION SYSTEM

Honey and Stewart (2002) defines certification with regards to buildings as a procedure that assess and gives transcribed reassurance that a building meets specific standards. Certification has the ability to ensure accountability to their stakeholders as well as meeting and balancing their interests. A Green Certification System measures a building's sustainability by applying a set of criteria arranged in different categories (Yuce, 2012). Green certification of building was introduced to alleviate "greenwashing" within the industry and to provide a standardised method used in

green building (Hoffman and Henn, 2006). The rise of sustainability as an important factor in the field of architecture, environmental impact of construction and operation of buildings has captured the attention of professionals for some decades now (Lee, 2013). Key amongst their concerns are issues related to global warming as a result of CO_2 emissions, pollution from building operations and excessive use of natural resources for new construction activities (Crawley and Aho, 1999; Cole, 1998). Green building certification system popularly known as green building certification system has emerged as an imperative consideration in the design and construction of buildings (Ding, 2008; Cole, 1998). A Green building certification system combines a number of sustainable indicators to be able to ascertain the sustainability level of a building. Adegbile (2013) indicated that the aim of any green building certification system is to set standards by which a structure can be rated, and provide a score or descriptive rating based on the assessment. Sokolov (2016) further added that the assessment is based on the standards, criteria and requirements that need to be met in order to be recognised as "green". The requirements of green certification systems are usually stricter than those required by national building codes (Sokolov, 2016). This makes green building certification systems more advanced and sustainable to promote development of buildings that perform better than average (McGraw-Hill Construction, 2013).

These green certification systems can be categorised into two namely; Quantitative and Qualitative certification/assessment systems (Sebake, 2009; Forsberg and von Malmborg, 2004). In the qualitative valuation systems, buildings are audited based on the rating of the assessed criteria which generates a total score for building performance (Sebake, 2009). Examples of the Qualitative Valuation systems are Green Star, BREEAM and LEED. The life cycle approach is used in the quantitative

assessment system which needs the quantifiable contribution and production data on the flow of energy and other matters (Forsberg and von Malmborg, 2004) with ATHENA and Eco-Quantum as examples. The quantitative criteria require annual water consumption, annual energy use and annual greenhouse gas emissions (Ding, 2008). The green building certification system is designed to be easily incorporated by designers and the market in general usually formatted as a checklist and linked to some kind of performance certification (Forssatti, 2008). United Nations Environment Programme (2013) encourages developing countries undergoing rapid urbanisation to formulate policies that boost property inventers and construction companies to integrate energy and greenhouse gas emission attentions into their likelihood and design stages of buildings. The assessment of a building is based on the framework of standards, criteria and requirements that a building project must meet in order to be recognized as "green" (Sokolov, 2016). This presupposes that there is a direct link between green building and certification system.

Several countries around the world have developed their own green building standards. These standards include Building Research Establishment's Environmental Assessment Method (BREEAM) in the UK, Leadership in Energy and Environmental Design (LEED) in the USA, GREEN STAR in Australia, and Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) in Japan, Green Mark from Singapore, Green Building Index from Malaysia, among others. These certification systems offer a menu of building technologies and construction practices, including Water Efficiency, Material Efficiency and Energy Efficiency, Materials and Resources as well as other categories.

2.5 GREEN CERTIFICATION SYSTEMS IN DEVELOPED AND DEVELOPING COUNTRIES

There are several certification systems worldwide, however, this section discussed only four certification systems because they are the most widely used in more economically developed and developing countries (Ozolins, 2011). The Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) are used extensively beyond the countries of origin. Those certification systems have and are still being adopted by countries that are in the processes of developing their certification systems (Sebake, 2009). For instance, the partial certification system which is being used in Ghana was adopted from the South African certification system which was also adopted from the Australian Green Star. As a matter of fact, this paper discusses four certification systems (Green Star Australia, Green Sa-Ghana, LEED and BREEAM).

2.5.1 Leadership in Energy and Environmental Design (LEED)

Leadership in Energy and Environmental Design was introduced by the United States Green Building Council (USGBC) in 1998 to transform how buildings and communities are designed, constructed and operated (Say and Wood, 2008). LEED has the following as assessment categories; LEED for New Construction, LEED for Core and Shell, LEED Commercial Interiors and LEED for Existing Building Operations and Maintenance, LEED for Homes, LEED for Neighbourhood Development, LEED for Schools and LEED for Retail (Cole and Jose, 2013; Say and Wood, 2008). It is a voluntary standard for sustainable buildings (LEED, 2012). The United States Green Building Council (USGBC) is made up of stakeholders in the construction industry including contractors, owners, architects, engineers, environmental groups and product manufacturers (Say and Wood). Potbhare et al.

(2009) indicated that there are about 51,452 LEED or more Accredited Professionals and 91,000 individuals who are keenly engaged in the promotion of LEED. According to Kibert (2004), the number of buildings applying to the USGBC for green building certification has been doubling each year since its implementation. LEED has been adapted by countries like India, Chile, Columbia, Sweden, and Canada (Cole and Jose, 2013). The categories under the LEED certification are sustainable sites, energy and atmosphere, water efficiency, materials and resources, indoor environmental quality, innovation and design process. Gundogan (2012) is of the view that compliance in the US and Europe on green building certification is more widespread because the requirements came from top down. LEED has been promoted through the creation of different membership base, certification of professional, education and government encouragement. Because LEED is a voluntary certification system, the USGBC does not necessarily involve in generating policies, regulations, or financial incentives. However, the United States government has a determined energy and green building goals for prevailing and new building stocks; and this has caused the LEED certification to be selected for the massive majority of government new construction projects (Winrock International Institute for Agricultural Development, WIIAD, 2014). Table 2.1 represents the categories that are used in certifying buildings using the LEED certification system.

Table 2.1 LEED Points Categories

LEED Categories	**Possible Points**
Sustainable Sites	26
Energy and Atmosphere	35
Water Efficiency	10
Indoor environment Quality	15
Materials and Resources	14
Total	**100**
Innovation and design process	6
Regional Priority Credit	4

Source: LEED Points Distribution (USGBC, 2009a)

2.5.2 Building Research Establishment Environmental Assessment Method (BREEAM)

BREEAM was developed in the United Kingdom in 1990 by Building Research Establishment Global Limited (Building Research Establishment Global, 2012). According to WIIAD (2014), the UK was the first nation in the universe to develop a green building certification system under the supports of the Building Research Establishment which was established in 1972. Since then more than 115,000 buildings have been certified in the United Kingdom with an additional 700,000 registered for eventual certification (Ozolins, 2010). These assessment tools include the BREEAM Design and Procurement (D&P), BREEAM Post Construction Review (PCR), BREEAM Fit Out (FO) and BREEAM Management and Operation (M&O) (Saunders, 2008). Presently, there are ten categories for assessment specifically for new-fangled construction in workplaces: energy, water, waste, land use and ecology, management, health and wellbeing, transport, materials, pollutions and innovation (Building Research Establishment, 2014). The total number of credits is multiplied by an environmental weighting factor in each category. Since 2000, the government in UK has made BREEAM a mandatory mechanism for all government procurement in

the UK (Schweber, 2013). Table 2.2 represents the categories that are used in certifying buildings using the BREEAM certification system.

Table 2.2 The BREEAM assessment method weightings

Category	**Weighting**
Energy	19%
Water	6%
Materials	12.55
Waste	7.5%
Transport	8%
Health and Wellbeing	15%
Pollution	10%
Management	12%
Land use and ecology	10%
Total	
Innovation (Optional)	

Source: Banani (2011)

2.5.3 Green Star Australia

The Green Building Council Australia (GBCA) developed Green Star Australia as a voluntary rating system used to assess the environmental design and building of all Australian structures (Say and Wood, 2008). The GBCA launched the Green Star in 2003 with the main objective to help the construction industry clasp sustainable building by encouraging green building programs, technologies, design practices and operations (GBCA, 2009a). Consequently, South Africa and New Zealand have adapted Green Star to rate and certify green buildings (New Zealand Green Building Council, 2009). Though the Green Star rating tool is obtainable for self-assessment of a design or scheme, one cannot widely promote green star rating system or use its logo without prior validation of the project's attainment through an official evaluation (GBCA, 2009a). According to GBCA, projects that are conferred one to three stars may not be specialised but those awarded with four or more stars may be certified.

The categories under the Green Star are: energy, water, materials, land-use and ecology, management, indoor environment quality and pollution among others. Since the inception of Green Star in 2003, about 726 buildings have been certified with 450 projects recorded for certification (GBCA, 2013). Also, a report by GBCA (2013) states that a certified building uses 66% less electricity, produces 62% less greenhouse gas emissions and consumes 51% less water. Table 2.3 represents the categories that are used in certifying buildings using the Green Star certification system.

Table 2.3 Green Star Certification Categories

Green Star Categories	Possible Points
Energy	29
Water	12
Materials	25
Indoor Environment Quality	27
Transportation	11
Management	12
Land use and ecology	8
Emission	19
Total	**143**
Innovation	5

Source: GBCA (2012)

2.5.4 Green Star SA-Ghana

The Green Star SA-Ghana is the certification system for Ghana as decided by the Ghana Green Building Council (GhGBC). The GhGBC chose the Green Star South Africa Building Rating System because of its ease of use, ease of customization to Ghana and because of the logical transition from the existing tool to its own tool (Osae-Akonnor, 2014). In the certification of the One Airport Square for instance, GBCSA wrote a report to GBCA to allow for certification of the One Airport Square building in Accra using the Green Star SA but with some minor recommended changes, but call the tool Green Star SA-Ghana (Alfris and Braune, n.d). This exhibits

that Australia has some amount of control over the certification tool because Green Star South Africa originated from Green Star Australia. This confirmed what Ozolins (2010) identified about BREEAM and Green Star certification system, as have been used in their country of origin but offer guidance for the development of green building rating systems for other countries or regions based on their model.

The rating system is used to certify non-domestic building types. The categories in Green Star SA – Ghana are sustainable sites, energy and atmosphere, water efficiency, indoor environment quality materials and resources. The GhGBC adopted the Green Star SA rating tool and therefore called it Green Star Ghana-SA. According to Redl (2003), green certification schemes are rarely taken into account when there is lack of interest and knowledge in green certification schemes. Nonetheless, if stakeholders have an experience with green certification, they are often willing to apply this certification on other future projects as well (Redl, 2013).

The GhGBC defines commercial buildings according to the Standard Building Code (SBC) as or retail and service establishments, offices, institutional buildings (e.g. schools, museums, libraries and religious institutions), hotels and residential buildings of four or more habitable stories are eligible for certification under the building rating system (Ghana Green Building Council, 2010). But the current Green Star Sa-Ghana is used to certify non-domestic building types. The certification process for Green Star do not monitor the performance of buildings once they are constructed but are more concerned with the equation that specific features will give specific performance. This makes Green Star SA-Ghana a qualitative assessment system. Table 2.4 represents the categories that are used in certifying buildings using the Green Star SA-Ghana certification system.

Table 2.4 Green Star Ghana Criteria

CATEGORY	DESCRIPTION
Sustainable sites	• Land Use (encourages the use of brown fields and discourages the use of green fields) • Minimizing the building impact of ecosystems and waterways • Landscaping • Transport • Control of storm water runoff • Light pollution • Reduction of erosion • Construction-related pollution • Heat effect
Water efficiency	• Encourage the smart use of water through the use of fixtures and fittings and efficient appliances
Energy and Atmosphere	• Efficient design and construction • energy use monitoring • use of clean sources of energy, generated on-site or off-site • Other innovation strategies
Materials and Resources	• Reduction of waster as well as reuse and recycling • The use of sustainability grown, harvested, produce and transported products and materials
Indoor Environment Quality	• Access to natural daylight • Improving acoustics • Strategies to improve indoor air

Source: GhGBC website, 2017

2.5.4.1 Ghana's Pioneer Green Building - One Air Port Square

The One Airport Square building in Accra is the first green building in Ghana certified with the Green Star SA-Ghana certification tool. The green building attained a certification level of four stars Alfris and Braune (n.d). The building has several green building features that is intended to ensure that the building operate more efficiently and with less environmental impact. The building uses natural ventilation through openable windows and uses an under floor "cool" air distribution system (International Union of Architects, 2011).

The key aspects of One Airport Square are public spaces, solar building integration, vernacular building strategies, public spaces, integrated planning process, renewable building materials, participation of users in planning process, use of innovative design tools, low cost designs, the use of locally manufactured building because of the high import duties (International Union of Architects, 2011)).

Redl (2013) asserts that green certification tool is usually applied to a pioneer's project from the inception of the project through the arrangement stage to the final contracting of a building and after three to four years, the certification system becomes more recognized on the market. However, the green certification tool has not fully diffused into the construction industry after its inception in 2009. This is evident with the number of green buildings since its introduction in Ghana. Table 2.5 below is the list of criteria used to assess the One Airport Square in Ghana.

Table 2.5 Green Star Ghana Criteria

CATEGORY	DESCRIPTION
Sustainable sites	• Land Use (encourages the use of brown fields and discourages the use of green fields) • Minimizing the building impact of ecosystems and waterways • Landscaping • Transport • Control of Storm water runoff • Reduction of erosion • Light pollution • Heat Effect • Construction-related pollution
Water efficiency	• Encourage the smart use of water through the use of efficient appliances, fixtures and fittings
Energy and Atmosphere	• Energy Use Monitoring • Efficient design and construction • Efficient appliances, systems and lighting • Use of clean sources of energy, generated on-site or off-site • Other innovative strategies
Materials and Resources	• The use of sustainably grown, harvested, produce and transported products and materials • Reduction of waste as well as reuse and recycling.
Indoor Environmental Quality	• Strategies to improve indoor air • Access to natural daylight • Improving acoustics

Source: GhGBC website, 2017

2.6 CURRENT STATUS OF GREEN BUILDING CERTIFICATION SYSTEM

Energy is used for the heating, ventilation and air conditioning (HVAC), water, heating, lightning and telecommunication which contribute to about 80% of greenhouse gas emissions (United Nations Environment Programme, 2009). Ozolins (2010) confirms that heating and cooling systems are an integral part of virtually every building and a major consumer of a building's financial and energy budgets. Table 2.6 demonstrates that energy as a category has the highest weighting as compared to the

other categories in the various certification system. Therefore, it can be asserted that the weighting for the energy category has the highest because of the gas emissions that take place during the operational phase. On the account of the impact of energy, it is considered as a key category in most assessment methods (Banani, 2011). United Nations Environment Programme (2009) posits there can be great reduction in greenhouse gas emissions by targeting the operational phase of a building. According to Retzlaff (2008), LEED is the most commonly used and widely known certification system. Ozolins (2010) also affirms that, among the four main green building rating systems in the English-speaking world, the LEED system is the only one which is actively promoted to be used outside of its country of origin. With 26,000 registered projects with LEED, 280 are outside the U.S and Canada in 35 countries around the world. BREEAM and Green Star certification system is used in their countries of origin and offer guidance for the development of green building rating systems for other countries or regions based on their model (Ozolins, 2010). Table 2.6 shows the categories of the leading green building certification systems.

Table 2.6 Categories of the various green building certification system

Items	BREEAM %	LEED	Green Star
Energy	19	35	29
Water	6	10	12
Waste	7.5		
Materials	12.5	14	25
Indoor Environment Quality or Health and Wellbeing	15	15	27
Economics			
Management	12		12
Land use, Site and Ecology	10	26	8
Mobility and Transportation	8		
Emissions and Pollution	10		19
Resources			
Cultural and Social			
Total	**100%**	**100**	**143**
Innovation	10%	6	5
Regional Priority Credit		4	

Source: Banani (2011)

2.6.1 The World Green Building Council

In 2002, eight nations formed the World Green Building Council (WBC) an independent non-profit organisation whose mission is to accelerate the transformation of the built environment towards sustainability (Medineckinene et al., 2014). Its mission was to support evolving green building councils by providing them with strategies and tools to create strong organisations and leadership position in their countries (World Green Building Council, 2013). World green building council engages leaders across sectors to effectively engage in transforming the built environment (Medineckine et al., 2014). It is an umbrella organisation with regional networks from Europe, Asia-Pacific, America and Africa (Malanca, 2010). It can therefore be deduced that the importance of green building councils should never be underestimated because they are the focal point in trying to integrate stakeholders into

adopting green building certifications. Green building councils can either adopt one of the existing tools that authorises it to be used in other countries with no or minimal changes or adopt one of the exiting tools that allows it to be used in other countries with customization for local context (Slabbert, 2013).

2.6.2 Green Building Councils in developed countries

2.6.2.1 United State Green Building Council (USGBC)

The United States Green Building Council (USGBC) is a non-profit consensus based organization which developed the Leadership in Energy and Environment Design (LEED) (Say and Wood, 2008). The Department of Energy (2007) in United States reports that, buildings consume approximately 40% of all energy, 72% of all electricity and produce 39% of primary greenhouse gas emissions. The environmental awareness among the general public led to green building adoption in USA (Kanyaura and Obino, 2015). This was further reinforced by the response of the government to environmental movement in the form of policy initiatives. Based on the number of criteria met, a facility can be categorized as certified (26-32 points), silver (33-38 points), gold (39-51) points or platinum (52 plus points) (Fuerst and McAllister, 2008; May and Koski, 2007). The USGBC has more knowledge and access to practical experience than any other organization (Snavely, 2007). Their technical experience and information has been designed to be used as a blueprint for firms that want green buildings. Thus, this has provided the confidence that these organisations and firms have in USGBC and has contributed to growth of the green building certification in the country (Snavely, 2007). Members also gain the advantage of serving on committees that are the core components in their ability to provide industry guidelines for green buildings (Snavely, 2007). The growth of green buildings in the U.S has been due to the efforts of the city and the government initiatives, residential market activity and improved

quality, greater variety, and lower prices of sustainable materials (Say and Wood, 2008).

2.6.2.2 United Kingdom Green Building Council (UK-GBC)

UK-GBC is a non-governmental organisation that pursues a sustainable built environment. Their vision is to have a built environment that enables a high quality of life for people (UK-GBC, 2013). Their mission is to improve the sustainability of the built environment, by changing the way it is planned, designed, constructed, maintained, and operated. According to the UK-GBC, they can do more by engaging sectors through collaborations with trade bodies and professional bodies. In so doing, their challenge is to engage people who are new to green buildings and have a key role in driving positive change in this area (UK-GBC, 2013).

2.6.2.3 Green Building Council of Australia (GBCA)

The GBCA was established in 2002 as a non-profit organisation to promote the development of sustainable property industry (GBCA, 2013). The organisation is currently ran by about 57 staff in positions for executive management, advocacy and business services, finance, IT, legal, Green Star certifications and commercial business (Hanoi, 2014). There are 862 accredited professionals (GBCA, 2013) and services provided to members which include annual green building conference, professional certifications and government advocacy. The GBCA also organizes forums, case study seminars, boardroom lunches and annual green building conference called Green Cities (GBCA, 2013). The GBCA pursues other means of driving the built environment to sustainability by government advocacy, a monthly newsletter with more than 15,500 subscribers and over 80 events in 2013 including an annual conference, research report writing and disseminations (GBCA, 2013).

2.6.2.4 New Zealand Green Building Council

The New Zealand Green Building Council (NZGBC) is a not-for-profit administration established in 2007 that leads green building initiatives in New Zealand (NZGBC, 2014). Currently, New Zealand has been able to introduce the suite of Green Star NZ rating tools, Homestar residential rating tool, BASE introductory level green building and the NABERSNZ energy performance rating tool (NZGBC, 2014). As part of their activities, the NZGBC has people in Green Star, Homestar and NABERSNZ. The NZGBC proposed to the Auckland Unitary Plan committee that all new residential developments which have five or more houses be designed and built to attain either at least 6-star level from the New Zealand Green Building Council Homestar Tool (2013) or a certification under the Living Building Challenge (2013) (NZGBC, 2014).

2.6.3 Similarities between Green Building Councils in Developed Countries

Green building council exist to help countries to adopt practices that can conserve and efficiently utilize their limited resources. It also exists to help stakeholders in the construction industry to reduce the effects of construction activities on occupants living in buildings. Therefore, a country with a good green building council which is seen actively pushing for the green building certifications have more green buildings. The similarities deduced from the USGBC, UK-GBC and GBCA and NZGBC have been presented in Table 2.7 below.

Table 2.7 Similarities between Green Building Councils in Developed Countries

S/N	SIMILARITIES
1	They are all non-profit organizations;
2	They seek to promote safe practices of construction in order to effectively utilize the limited resources whilst reducing carbon print and improving the health of occupants who patronize those facilities;
3	They promote themselves to have more knowledge and practical experience concerning green building certification;
4	Their technical experience and information has been designed to be used as a blueprint for firms that want "green;
5	Individuals and organizations have used the green building certification systems developed by these green building councils and have reported to have helped them;
6	They have regular seminars for individuals and organizations on green building certification;
7	They have the full support of their various governments not just by word of mouth but by the government actually constructing some of their public buildings according to those certification systems.

Source: Author's own construct, 2017

2.6.4 Green Building Councils in developing countries

This section only discusses Green Building Council South Africa, Kenya and Ghana Green Building Council. Green Building Councils in most African countries are under the authority of the Green Building Council South Africa as they have been given the mandate by the World Green Building Council to nurture the establishment and support the activities of the green building councils in these countries.

2.6.4.1 Green Building Council of South Africa

The Green Building Council of South Africa (GBCSA) is a not-for-profit institution established in 2007 (van Wky and Xulu, 2011). The Green Star Sa was developed by adapting the Green Star Australia (Slabbert, 2013). The mission of GBCA is to encourage and boost the adoption of green building through market-based solution (GBCSA, 2013). The total number of certified buildings as at January 2014 were 50

buildings, of which, 42 properties are private divisions owned by banks, property funds and individual corporates as head offices and the remaining 8 are a range of government owned properties (Rogerson, 2014). The GBCSA has been mandated by the World Green Building Council to nurture and support the establishment of a wider network of green building councils throughout Africa (GBCSA, 2013a). Following the emergence of new green building councils in Kenya, Ghana, Namibia and Nigeria and the other potential green building councils to be established in Tanzania, Malawi, Zimbabwe and Zambia, Rogerson (2014) recommended that it is imperative for continuous observation of the green property developments in South Africa as a possible learning source for the rest of Africa.

2.6.4.2 Kenya Green Building Council

Kenya is slowly joining countries who have adopted green or environmentally sustainable architecture in real estate development. This initiative is largely informed by the diminishing natural resources such as fossil fuels, water and resources that were originally inexhaustible (Kanyaura and Obino, 2015). Currently Kenya does not have certification for green building but rather it relies on South Africa to manage and allow its certification through its existing established processes but calls it Green Star SA-Kenya. The Green Building Council South Africa (GBCA) has the sole responsibility of allowing capacity to grow in Kenya by allowing selected Kenyan professionals to be trained as Green Star SA-Kenya assessors who would join the GBCSA assessor teams on Kenyan projects (Athena, 2014). Green building concepts have been incorporated in buildings such as Coca Cola head offices in upper hill, Strathmore Business School and Standard Chartered Bank (Were *et al.*, 2015).

2.6.4.3 Ghana Green Building Council (GhGBC)

Ghana Green Building Council (GhGBC) was registered by the Registrar General Department in August 2009. The mission of GhGBC was to incorporate sustainability in the way buildings are designed, constructed, planned, operated and maintained. Hence, changing the built environment for a greater good (GHGBC Handbook, 2011). According to Wang et al. (2012), scholars have moved their attention from sustainability practices and the motives behind sustainability for the past decade. Rather this attention is directed to making schemes for enforcing change that is the approaches needed to be taken. Wang et al. (2012) further assert that much research is needed to grasp the reasons for making the change and how to manage the change which is the implementation of green buildings.

2.6.5 The need to certify buildings and the role of government of Ghana in the green certification of buildings

Although Ghana Green Building Council allows for the use of green technologies as stated, this voluntary based certification scheme produces less inducements for developers to adopt innovative green technologies. According to Landman (1999), the responsibility for learning, educating, demanding and implementing more sustainable or green practices depends on the government rather than the private sector. Also the government involvement gives legitimacy to the efforts of environmental advocacy groups like the Ghana Green Building Council. Even the private sector presumes and anticipates that governments should be seen as helping, like only providing support and encouraging organisations or individuals that willingly select green building certification (Brian, 2006). According to United Nations Environment Programme (2007), it appears undoubtedly true that in many countries the solution can be reached if governments are actively involved in creating a working framework for green

buildings. It further affirms that leaving the private sector to promote green building not considering any outside support mostly leads to failure. Mostly, the challenge to green buildings is the lack of leadership and help by the several ranks of government (Sangster, 2006).

The absence of active government's coordination and consistency in its polices concerning green building certification frustrates the efforts of the GhGBC in promoting this agenda. For green building to be firmly rooted in Ghana, the government would have to have an undulating partnership with the GhGBC and other stakeholders to encourage the Ghanaian populace to adopt the practise of "greening" their buildings. Government is frequently the main single owner of structures in a country and is an opportunity to be helpful to green structures and inspire development like these (Sangster, 2006). Applying green certification in government buildings demonstrate environmental and leadership responsibility. Active presence of government in promoting green building certification also reduces uncertainty related with regulations (King and Lenox, 2000). It also provides an informative approach for companies regarding certifying their buildings to be green by giving understanding into what methods are effective in reaching analogous objectives. Furthermore, Engel (2006) posits that governments are the proving ground for green building because their short-terms and uncertainties are forced-out by long-term concerns related to sustainability and climate change. By so doing, governments that select to certify their buildings engage the services of experts in green buildings (Koski and Lee, 2011).

2.6.6 Lessons from Green Building Councils of other countries

2.6.6.1 Australia

In Australia, the building sector contributes to 20% and 23% of Australia's annual energy consumption and greenhouse gas emissions respectively (Lawania and Biswas, 2016; Australian Building Codes Board, 2015). In so doing, there is a major initiative in Australia to promote green building which will reduce greenhouse emissions through the reduction of energy consumption and resource conservation (Wilson and Tagaza, 2004). The government of Australia's commitment has led to the Green Star certification of 68 government-owned building projects around Australia (Wilson and Tagaza, 2004). The support of the government towards the green building certification system was in a form of financial incentives, such as tax and funding solution, and non-financial incentives, such as green door policies and provision of green skills training (Wilson and Tagaza, 2004). In order to demonstrate the government's commitment to green building in Australia, the government agreed to design and construct by Green Building Council Australia's rating standards a 'six star' world class building to accommodate administrative staff (Wilson and Tagaza, 2006). The Szencorp building in Australia reported energy savings of over 70% after two years of operation (New Zealand Green Building Council, 2010).

2.6.6.2 United Kingdom

The UK has a press called the UK Green Building Press that publishes green building information monthly on a website in many mediums to help people create healthy and ecological homes, offices and other buildings (Sangster, 2006). As part of the Government's ambition to be the greenest government ever, it introduced the Greening Government Commitment (GGCs) in 2011 (Department of Energy and Climate Change, 2014). It also has Energy Saving Trust (ESTR) which operate many

incentive programs to help people increase home energy efficiencies and to decrease energy consumption (Sangster, 2006). The UK government now mandates that all new and renovated government buildings receive BREEAM certifications (Winrock International Institute for Agricultural Development, 2014).

2.6.6.3 United States

In the US, the growth of green buildings has been increased by the city and government initiatives and the low prices of sustainable materials through the efforts of the government (Say and Wood, 2008). The government in the U.S. involves itself in promoting green building. An example is the Seattle city government legislatively adopting strategies to creating green municipal buildings in the year 2000 (Sangster, 2006). In the US, the government dominantly uses the economic instrument target as its tactics in promoting green building. Some cities in the US that have passed obligatory standards to use them on mostly public projects and those that use public funds. Other cities also decrease the burden of land use regulation for developers or building owners who adopt green building techniques and certify their buildings subsequently by accelerating the ecological authorising process or lessening reporting requirements (King and King, 2005).

2.6.6.4 South Africa

In South Africa, the upsurge in mindfulness of energy efficiency and change in the climate globally has meaningfully impacted the construction industry in current years (Hoffman, 2013). Since the establishment of the Green Building Council South Africa, there has been a total of 36 certified green buildings. This shows that South Africa is strong when it comes to green building certifications (GBCSA, 2013; McGraw-Hill, 2013). The government has decided to reduce greenhouse gas emissions by 34% by

2020 and 42% by 2025 (Construction Industry Development Board, 2011). The South African government adopted a National Green Building Framework to help with the commitment of green building. A key strategy was to improve regulations and standards for green building (Van Wyk, 2012) by passing the SANS 10400 and Part XA of the Building Regulations, hence acting as a guideline to design and construction of South African green structures.

2.7 DRIVERS OF GREEN BUILDING CERTIFICATION

Many are beginning to understand the strategic needs of green buildings which depicts an extensive structural change. The structural change came from overwhelming look for changing patterns of regulation and policy of the government which have resulted in an increased information on good green materials, more strategic construction industry, green building, more improved efforts of the financial sector of the government to encourage green certification of buildings (Commission for Environmental Cooperation, 2008). Therefore, better and deeper understanding of these drivers is essential to encourage widespread adoption of green building certification because such an understanding could significantly impact green building certifications decision and help potential adopters to accept it (Darko *et al*., 2017). In this research the term "drivers" is defined as the reasons why stakeholders decide to adopt green certification of buildings. Discussed below are some international perspectives on the drivers of green building certification.

2.7.1 Ensuring governmental policies

Governments or public authorities have adopted a number of regulations and policies aimed at incentivizing or mandating individuals to adopt green building certification (DuBose *et al.*, 2007). Research proves that governments in countries like USA, UK

and Canada are working to address obstacles in green building certification through building codes, zoning regulations, incentives based on tax among other things (Commission for Environmental Cooperation, 2008). Incentives of green building promotes green building integration and those responsible for its provision is the government (Olubunmi *et al*., 2016). Incentives for green building implementation is described as instruments that influence people's behavior (Frances and Sivasailam, 1992). Qian and Chan (2010) purported that the government provides incentives in countries like UK, Canada and the US to influence people to certify their buildings. In the U.S for instance, there are several legislations, executive orders, and national policies that require or encourage green building practices in different states (Darko *et al*., 2017). In other states like Washington and California, owners and developers submitted that they build sustainably because of highly strict local codes and regulations regarding site selection, energy, and recycling (Korkzmaz, 2007). In China, mainstream green building preforms mostly receives integration from the government because of their aim to reduce energy usage, consider their energy supply and other issues relating to the environment which is the main force which drives their policies. The Scandinavian countries were the first to introduce regulations that mandate building energy-efficiency and comfort improvements (Allouhi *et al*., 2015). The EU also requires its member states to attain extreme standards of efficiency and obtain energy performance certificates for all new construction and renovations through the EU Energy Performance of Buildings Directive of 2002 (Energy Performance of Buildings Directive, 2002). In order to demonstrate its commitment and leadership, the government of Malaysia is seen to be on the green building mantra, turning four iconic structures (The Diamond Building, Putrajaya, Kuala Lumpur

Securities Commission building, Green Technology and Water Building (LOE Energy Office Building Green Tech Malaysia) into green buildings (Aliagha *et al*., 2013).

2.7.2 Promoting green building incentives

In Malaysia, the government is using sequence of green tax immunity and diminution and incentive investment to improve green building integration in the private and public sectors (Aliagha *et al*., 2013). Upon several studies over the years, it has been purported that green building incentives is still on the dwindle in most countries (Darko and Chan, 2016) which Ghana is no exception. According to Yang and Lim (2008), governments are concerned about development and reduction of impact on the environment. The government of Germany for instance provide incentives to promote green building by introducing tax credit portfolios and mechanisms for regulation while helping the implementation of other economic instruments (Luttzkendorf and Lorenz, 2006). In Philippines and Indonesia, the government has approved of green building certifications and it is now part of the requirement of building permits (Wiryomartono, 2015).

2.7.3 Strong Environmental Focus by Companies

Drivers for green buildings could include large advanced corporations (Bond, 2011). Most organisations occupy green buildings because of the company mission which is on a strong environmental and sustainability focus (Bond and Perrett, 2012).

2.7.4 Quest for Increased Productivity

Numerous researches have been conducted on indoor environment quality (IEQ) on health, comfort and performance of occupants (Kumar and Fisk, 2002). Low volatile paints are mostly used in green homes which has less impact on the health of the occupants, hence providing an improved indoor air quality compared to the

conventional households (Alias *et al.*, 2010). Occupying green buildings comes with benefits like increased productivity, reduction in sick leave and not coming to work, staff holding and attraction (Bond and Perrett, 2012).

2.7.5 Investment Appeal

According to Martianov (2016), certification in accordance with the green standards increase the investment attractiveness of the building. Guseva (2012) noted that there is an increase of net operating income by 5-9% because of increase of rental rates, increase of the occupancy rates by 2-16%, reduction of operating expenses by 25%-30% due to energy consumption, attraction and retaining of tenants. Mills (2003) attests that brokers will be more enthused and interested in renewable energy and energy efficiency if 1) the loss-prevention benefits are a lot 2) they are the main owners in real estate markets as well as commercial building owners and landlords; and 3) competitive forces make them to create improved services that make them different.

2.7.6 Quest for Cost Savings

During the operational face, about 80% of greenhouse gas emissions occur (Junnila, 2004; Adalberth *et al*, 2001; Suzuki and Oka, 1998). According to Jensen (2011), some of the most possible factors for adopting certification for green building is its building's operating cost such as the cost to maintain a comfortable working environment which includes heating and lighting expenses. According to the Green Building Council of South African (2013) report, a green star certified building in the country benefits from energy savings from about 25% to 50% when compared to structures designed to other building standards. Aliagha (2013), claimed that higher cost which was previously associated with green building may be as a result of the usage of quondam information. It also further stated incessant cost savings can be

achieved through good life cycle assessment, effective commissioning, operation and maintenance, integrated building designs and operation and maintenance. Hence, inadequate grasp of life-cycle costing and analysis which includes the design costs, costs in construction and also long term operations such as maintenance, repair, replacement costs in decisions and procurements of equipment is very likely to translate into extreme building costs. Also, Uma (2011) revealed that in Singapore market value of green buildings upsurges by 2% and the operating cost reduces by 10%. Morris (2007) opined that the cost of green building materials is getting less costly and its usage is also attaining a lot of acknowledgement, even tenants and house owners are now in tune with the need for green buildings.

2.7.7 Client Demand

Client demand for green building is an important trigger for sustaining the green market. This demonstrates how critical it is to create public awareness of the benefits of green and the importance of establishing the business benefits of green building since these are factors that drive clients to make investments in green. In order for clients to invest in green building, they would have to rely on the positive effects of green buildings (Hakkinen and Belloni, 2011).

2.7.8 Quest for Branding and Prestige

Most companies which have good records on their involvement in GB are normally invited to bid for GB projects. Kato et al. (2009) identified in his study that building managers are also elated for being Green Star-rated office building which gave them a competitive advantage as a sustainable leader in the industry. The report from the Green Building Council of South Africa (2013) stated that green buildings create distinct products in the market which are viewed as technologically advanced and

environmentally and socially responsible. This therefore has a positive impact on the organizational brand and on the image of the building owner including the tenant of green buildings.

2.8 BARRIERS TO GREEN CERTIFICATION OF BUILDINGS

One of the factors that has helped raise interest in green building is climate change but, its adoption is comparatively small with huge barriers to its fast expansion (Commission for Environmental Cooperation, 2008). The vision of Green building certification is to escalate sustainability, preserve occupants' health, lessen operation costs and conserve energy (Zhang *et al.*, 2012). The barriers are not the same for every country. Factors such as economic, political, environmental and cultural can affect the extent of these barriers. This is similar to any new change, its adoption and acceptance is very challenging. Recognizing building barriers of green certification and adopting ways to cumber them, stakeholders will have increased trust in them for their usage (Warren and Taylor, 2008). Some of the barriers to green building certification are discussed below.

2.8.1 Regulatory Processes and Codes

Roles played by the government is very significant when it comes to green building promotion (Mosly, 2015). Governments or public authorities have adopted a number of regulations and policies aimed at incentivizing or mandating green building practices (DuBose *et al.*, 2007). These regulatory and legislative requirements put pressure on all major construction. Regulatory and legislative requirements are effective and influential in both leading change and raising awareness (Arif *et al.*, 2012). The government can set a number of regulations that support green certification of buildings which obliges the public to adopt (Arif *et al.*, 2012). Inadequate incentives

for green building technologies and systems is one of the governmental barriers. Incentives have a main purpose because they encourage people to acquire government-listed products. Sokolov (2016) stated that the production of green building on a national scale happens because of policy makers of the government, research and development institutions, building designs and financial institutions and public organisations.

2.8.2 Lack of data base of using green building assessment system

Inadequate data on the use of green building valuation system is a barrier (Shi, 2008). When there is no easily accessible record for green materials and its product, which is very much needed for assessment it drives people away from adopting after they have become aware of its benefits (Shi, 2008). According to Chang et al. (2016), lack of database and knowledge of green building certification systems are seen as the main obstacles. The green specification (catalogue on green products and associated technical standards) enhance the mindfulness of project members to easily obtain the needed resources for green buildings (Zuo and Zhao, 2013). This is surely a new and upcoming field, and new products like EcoSpecifier are giving help on environmental impact of generally obtainable building products (Wilson and Tagaza, 2008). EcoSpecifier is a profitable databank of building products that have been tested to sustainability criteria independently.

2.8.3 Lack of Training and Education

The development of green building certification hinges on the availability of skilled and trained people to fill the emerging green jobs (Hammer *et al*., 2011). For a tremendous increase in green building certifications, the professionals in the industry must be endowed with green construction skills. Nevertheless, this requirement has

not been obtained yet. Notwithstanding, a handful of architects and engineers are skilled with project design and construction, but not much can be said of them when it comes to sustainable construction much less when we talk about green building assessment practice (Shi, 2008). There is a direct relationship between performance and experience of project members (Young and Samson, 2008). Experience and skills are imperative for increasing environmental experience and performance (Li *et al*., 2014). Comparing green buildings to conventional buildings is imperative because green buildings make use of biodegradable materials, cutting-edge simulation and analysis, and also indoor environmental quality measures (Li *et al*., 2014). Therefore, there is the need to educate and train people to acquire the required expertise in their respective field. Marsh (2009) report identified the inadequate experience of consultants and contractors when it comes to green building works resulting in unsurmountable delays in the projects. Ashuri (2010) posited that contractors might lack the skill to adopt green oriented technology. Tagaza and Wilson (2004) verified that the major problem is that green technologies are mostly very difficult and varied from traditional technologies.

2.8.4 Lack of interest from real estate developers

According to Shi (2008), without ultimate rewards, developers are not concerned about adopting green building tools to check and improve their project performances. Green certification of buildings, though appears to be very good, but real estate developers, designer and contractors are mostly concerned with making profit. Moving entirely to green building mostly require new service providers, material sellers and the adoption of an integrated design process in order to build a comparable cost.

2.8.5 First Cost Barrier

First cost barrier is a significant disincentive to the adoption of sustainable principles in building. There is the need to have competitive pricing and financial incentives such as tax breaks so as to motivate users to demand for buildings which have been certified according to a green certification system (Mills *et al.*, 2012). Green buildings population is on the upsurge (Mosly, 2015). However, a lot of people make the mistake of doing basic calculations which mostly lead to high prices for green building making them choose conventional buildings (Mosly, 2015). The ingress of innovative technology from other countries also influences costs of adoption (Iwaro and Mwasha, 2010). There are inadequate support systems to offer distinct funds to assist technologies for building development (Zhang and Wang, 2013). The most frequently seen barriers are the dread of higher cost of investment of green buildings in relation to conventional building and the risks of unexpected costs (Hakkinen and Belloni, 2011). Zhou and Lowe (2003) posit that developers and investors have the fallacy that capital costs could rise when they veer into green construction and they lack the understanding of green methods in construction. Miller (2003) asserts that brokers would exceedingly be engrossed in energy-efficiency and renewable energy practices when other kinds of loss-prevention benefits have been identified.

2.8.6 Technical Difficulty during the construction process

Often the knowledge on green building methods and construction are complicated and require training (Zhang *et al.*, 2011). According to Tagaza and Wilson (2004), problems encountered during green building design and construction are due to lack of knowledge (Hwang and Tan, 2010).

2.8.7 Risk and Uncertainty

Though investments and interest in green building are on the rise there exist some risk and doubts regarding green buildings Some of them are vagueness over dependability of green building tools, incertitude over costs of evolving green real estate, uncertainty of economic benefits of green real estates and indecision about the building performance over time (Commission for Environmental Cooperation, 2008). According to a report by Marsh (2009), the building performance risk is rated to be one of the highest risks in the growth of implementation of green buildings. The building performance as stated by Ashuri (2010) has a significant influence in the decision making process to implement green buildings that will affect market positions. For instance, Turner and Frankel (2008) reported that some LEED buildings were found to be high energy usage but later the cause was found to be attributed to inefficient energy building performance due to the actions of the occupants and the facility managers in the building and malfunction of technologies and systems in the building.

2.8.8 Procurement and Tendering Processes

Green design depends critically on the type of contract selected for the project. (Tagaza and Wilson, 2004). When the contract used for green projects does not include the specifications of a complete implementation green design, this poses a challenge if the design is locked before it is developed fully (Hwang and Tan, 2012). One of the most important obstacles for successful green building is the difficulty to describe the requirements (Hakkinen and Belloni, 2011). Sustainable or green building is about achieving the required performance with minimum environmental impact and at the same time encouraging economic, social and cultural improvements at local, regional and global levels (International Standards Organisation, 2008). Adetinji et al. (2008)

mention that the focus on price of the procurement practices and low-risk culture are the main barriers for sustainable supply chain (Hakkinen and Belloni, 2011). This is because as procurement practices focus on price, the sustainability issues are not dealt with as contractual deliverables but rather as issues of faith. Ang et al. (2005) asserts that procurement processes are fundamental to improving building performance, and also sustainable building. They state that there is the need to change to a procurement system that draws upon knowledge of requirements at all states of the project, that includes life cycle costs-benefit analysis and that takes a holistic view of the value provided by the building of facility including environmental and social benefits. It is therefore widely assumed that traditional forms of procurement and tendering hinder innovation.

2.8.9 Project Delivery Mechanisms

Models of cooperation and networking, models of communication, roles of different actors, decision making and management processes and the scheduling of tasks are process related possible barriers for green buildings (Hakkinen and Belloni, 2011). The right timing and the presence of all needed actors in specific phases of sustainable building projects are addressed as key issues for the success of the projects. They suggest that it is important for sustainable building that construction organisations are included in the team during design. The roles of construction organizations are essential in providing estimating services. Accurate estimation of costs in the early stages of green building projects supports projects to select high performance and green building features based on the owner's budget (Hakkinen and Belloni, 2011). In selecting high performance and green building methods based on the owner's budget, accurate estimation of costs in early phases of green building projects is very necessary. Wilson and Tagaza (2008) affirm that the type of contract selected for the

delivery of the project will have a significant impact on the success of developing and implanting a green design. They assert that a traditional construction tender based on detailed design documentation or 'novation' contract or an 'alliance' contract can be successfully used for the delivery of green commercial buildings. However, 'design and build' contract or "Public Private Partnership" cannot successfully deliver green commercial buildings due to the design being locked in at an early stage before being fully developed and integrated. Buys et al. (2011) posits that contractors play a role in 'green building' by recycling and reusing construction debris, limiting the use of hazardous materials, protecting vegetation and using more efficient production systems. Integrated procurement systems (e.g. design and build, turnkey, engineer, procure and construct (EPC) would however permit contractors to participate more actively in green building design.

2.8.10 Integrated Design Teams

Successful green building projects require a considerable amount of investment in an integrated design team at the early stage with the following represented in the team: project owner, project manager, building contractor, architect, services engineer, structural engineer, environmental engineer, civil engineer, cost planner, building surveyor and acoustic expert (Wilson and Tagaza, 2008). Traditionally, conceptual designs are conceived by architects and developers and then passed onto the structural and services engineers and builders for design and construction. According to Elforgani and Rahmat (2010), architectural, mechanical and electrical designs are the most influential in the green building design process because these systems affect the building envelope, choices of materials and energy efficiency. Green buildings involve building orientation, energy consumption, ventilation and lighting considerations drive the design, expertise of the services engineer at the conceptual

stage (Buys *et al.*, 2011). This is in contrast with the traditional office building where the services engineer is only given the final design and asked to provide the lighting, heating and cooling systems to the sealed building (Buys *et al.*, 2011). The disadvantage is that the integrated design process takes longer but it is necessary to understand that the anticipated life-cycle savings can only be realized if the green building features and practices are fully integrated at the conceptual stage so that they function as one holistic system rather than stand-alone independent systems. Sodagar and Fieldson (2008) further iterates that in order to design a green building, the design team needs to have access to the best available information on products and tools. Green building requires the overall management of building performance and life-cycle impacts and it requires effective communication and cooperation (Hakkinen and Belloni, 2011). Horman *et al*. (2006) address the importance of cooperation in green building projects. They suggest the use of design-build-operate –maintain (a delivery method that integrates the designers, contractors and operation and the maintenance. This is a delivery method that integrates the designers, contractors and operation and the maintenance managers under one contract to the owner. Deane (2008) states that the preferred design model for delivering a green building is an integrated design process, which includes all involved parties (the owner, the developer, the designers, the builder, the tenant and the facility operator) from the beginning. Green building projects require careful material and system selection early in the project delivery process. Rohracher (2001) points out that green buildings cannot be properly constructed without a much closer interaction of suppliers, professionals and users than currently.

2.8.11 Lack of support from Manufacturers and Suppliers

By choosing environmentally preferable building products and materials, commercial and residential developers and builders can reduce the use of energy resources required to produce building products and materials, and save energy resources consumption during construction and over the span of a building's useful life (Wilson and Tagaza, 2008). The choice of construction materials has a significant impact on the health of building occupants and the environment as well. "Green" materials should be 1) reusable and recycled 2) should have zero or low emissions and toxicity 3) should have high recycle potential, durability and longevity 4) should have a greater flexibility under changing design requirements over the life of the building. Life Cycle analysis of materials is required according to Wilson and Tagaza (2008) in order to provide inventory and impact assessment of the materials and systems. Embodied energy studies are needed to assess the energy used by materials in its production including mining, manufacture, transport, installation, maintenance and finally demolition. In the U.S 'EcoSpecifier' is a commercial database of building products that have been independently vetted against sustainability criteria. The United States also have Greenbuild database in the USA which rates the environmental performance of building products. It is noteworthy that there has to be a balance between the environmental credentials of the material with the physical performance (Wilson and Tagaza, 2008).

2.8.12 Lack of Public Awareness

Lack of public awareness to sensitize people about the need to adopt green building practices can be seen as one of the obstacles to green certification of buildings in Ghana. The creation of the Ghana Green Building Council was expected to become a major step in promoting green buildings in Ghana. However, as it is now, the

productivity and effectiveness of the council's work is questionable. A research conducted by Osei (2016) identified that there is an awareness of the essence and benefits of green/sustainable buildings in Ghana among construction professionals, as well as the general public but green building certification has not been adopted massively by the built environment in Ghana. According to SmartMarket Report (2016), lack of public awareness is one of the top obstacles in many developing green markets in Brazil, Colombia, India and Poland. In India, there is lack of public awareness on the need for green building to flourish (SmartMarket Report, 2016).

2.8.13 Inadequate Human Capital

The development of green building certification hinges on the availability of skilled and trained people to fill the emerging green jobs (Hammer *et al*., 2011). According to United Nations Environment Programme (2008), shortage of skilled labour could bring to halt the green building. There is evidence that skill shortages already exist in certain green sectors around the world. In Germany for instance a report on lack of skilled solar photovoltaic (PV) technicians, whiles smart grid design engineers are in short supply in the United Kingdom. Solar technology installers and renewable energy technology project managers are needed in Spain and Denmark (European Centre for the Development of Vocational Training and International Labour Organisation, 2010). Demand for low-emission residential estates will require developers with knowledge of building materials with low-embedded energy use. A report by Marsh (2009) identified that lack of experienced consultants and contractors with respect to green building projects result in schedule delays of the projects. Ashuri (2010) identified contractors may lack the skills to properly implement green oriented technology.

2.9 THEORETICAL AND CONCEPTUAL FRAMEWORK DEVELOPMENT

2.9.1 Theoretical Framework

Simon and Goes (2011) define theoretical framework as an assurance that the type of investigation used in a study is not based solely on the researcher's personal instincts or guesses but rather informed by established theory and empiric facts obtained from credible sources. New products and services transmission in the construction industry is very slow (Reichstein *et al*., 2005). Goodrum and Haas (2000) postulates that one main accomplishment in the construction industry is their innovative ability as Portbhare et al. (2009a) identify green guidelines and assessment systems as innovation. Thus the theoretical considerations for this research is pinned on Hartman's (2006) and Roger's (2003) diffusion of innovation theory.

2.9.1.1 Innovation Diffusion Theory

The first framework is by Rogers (2003) called the Innovation Diffusion Theory. An innovation would be perceived useless no matter how well it is designed, if not adopted by the society *(ibid)*. Therefore, it becomes imperative that for easy adoption, those who want innovation should increase their extent for its diffusion (Chigona and Licker, 2008). One of the basic steps towards maximizing the adoption of innovation like green building certification is to grasp the components that affect its diffusion or the drivers that motivate the society to adopt such innovation. Mark and Poltrock (2001) identify innovation as a concept or a product that the adopter perceives to be new. Green building certification is not new for many developed countries like the U.K, U.S, Canada, Australia, Japan but it is a new concept for most developing countries like Ghana. Diffusion is a process in which a new approach or innovation is shared between identified or specified networks for a period of time among teams of a social system (Rogers, 2003). According to Diffusion of Innovation (DOI) these four

factors is very significant; the innovation itself, the channels for the communication, the time frame and the social system. DOI's version of diffusion occurs over time with preceding circumstances.

2.9.1.2 Innovation

Diffusion of Innovation's preceding attributes to the acceptance of an innovation are; relative advantage, compatibility, complexity, observability and trialability. These attributes when likened to the adoption of green building certification systems essentially means how much work must be involved in accepting this new concept as pitched against the benefits of adopting it.

Relative advantage is the extent to which an innovation is comprehended to be superior compared to the traditional method. Kato et al. (2009) identified in his study that building managers in Australia are elated for obtaining a competitive advantage over others because of them being in Green-Star rated office building. Hence, asserting them as leaders in the sustainability industry. According to Martianov (2016), certification in accordance with the green standards increase the investment attractiveness of the building.

Compatibility is the extent to which an innovation is comprehended to be in line with prevailing social cultural standards, needs, and previous familiarities of would-be-adopters. Rogers (2003) further states that an innovation that is not compatible with the prevalent ethics and customs of the social systems used and enforced as easily as the compatible ones. He further compared this innovation compatibility to the adoption of contraceptives in countries where sacred dogmas prevent the adoption of birth-control practises as in Moslems and orthodox nations.

Complexity is the extent to which an innovation is comprehended as being hard to appreciate and enforce. Marsh (2009) report acknowledged that inadequate experienced consultants and contractors in relation to green building works result in delays of projects. This characteristic correlates negatively with the degree of adoption. New concepts that are easy to grasp will be accepted swiftly than new ideas that need the adopter to acquire new skills and understandings. This can be likened to the green certification system in Ghana where the built environment would have to develop their capacity to be able to adopt this innovation. The development of green building certification hinges on the availability of skilled and trained people to fill the emerging green jobs (Hammer *et al*., 2011).

Observability is the extent to which the outcomes of an innovation are noticeable to others. Outcomes in most innovations are difficult to be seen from those who adopt them. Moore and Benbasat (1991) split observability into two; result demonstrability which is the ability to show that positive outcomes have happened for the user; visibility is the ability to divvy up those demonstrations with others. Djokoto *et al*. (2014) discovered that lack of demand is the biggest barrier to green building certification adoption. The Ghanaian society can better appreciate green building certification if the benefits of using the certification system on the few green buildings are visible for the would-be adopters to know how feasible that is. Without client and customer cognizance of the possible benefits of green building certification system, it will be hard for them to exhibit a love for them (Darko and Chan, 2016). Basically the GhGBC can liaise with the management of the green buildings and track the performance and benefits of them and make them public for the society. The would-be adopters would have to see the visible benefits of adopting this certification system. The rate of adoption and observability are positively correlated. Chigona and Licker

(2008) assert that abstract or vague innovations are usually challenging to adopt and its diffusion becomes very slow. Potbhare *et al.* (2009) established that the availability of better information is the most essential motivation to stimulate the adoption of green building certification. In order to ensure the widespread of this innovation the "information barrier" needs to be resolved in advance. This information can be distributed to society through the print media, radio programs and television shows (Darko and Chan, 2016). A dedicated website like the website for GhGBC can serve as database for reputable, current and standardized green building data which may be useful. Corporations will petition green buildings for it to be established that the higher indoor environment quality effects in enhancements of staff health, staff fulfilment and staff efficiency (Wilson and Tagaza, 2006). Documenting of such results will help occupants and corporations demanding certified green buildings which will result in a paradigm shift in how buildings are planned and built in this nation.

Trialability is the extent to which an innovation may be tested with on a few fundamentals before adoption with gratuitous cost. Redl (2013) asserts that green certification tool is usually applied to a pioneer project from the design and planning phase to the commissioning of the structure then after three to four years, the certification scheme is recognised on the markets. Research shows that One Airport Square was Ghana's first certified green building. One can further make the assertion that, with the pioneer certified green building, lessons were learnt, which the positive ones can be repeated in the future and the strategies would be adopted to alleviate or further eliminate the negative ones. A triable innovation characterises less indecision to the would-be adoptee because the innovation can be adopted by doing as done before.

2.9.1.3 Communication

Communication is the process by which members create and share information with one another so as to attain a mutual understanding. Diffusion is a specific type of communication in which the information that is bartered is associated with new ideas. Lack of public awareness to sensitize people about the need to adopt green building practices can be seen as one of the obstacles in green certification of buildings in Ghana. The formation of the Ghana Green Building Council was anticipated to be a major step in encouraging green building in Ghana. A research conducted by Osei (2016) identified that there is an awareness of the essence and benefits of green/sustainable buildings in Ghana among construction professionals, as well as the general public but green building certification has not been adopted massively in Ghana. According to SmartMarket Report (2016), lack of awareness of the general public is a top obstacle in many developing green markets in Brazil, Colombia, India and Poland. Hwang and Tan (2012) recommends that professionals in green building knowledge and experience should be enhanced to keep them updated with the evolving information for successful green building project delivery.

In a study conducted by Cheng and Ventaraman (2016) to analyze the connections between project team compositions and green building certification in green building projects, the project team information of all LEED certified buildings were collected from the Canada Green Building Council (CaGBC) database. According to Cheng and Ventaraman (2016), the CaGBC database was selected to conduct the analysis because it provides accurate project information of certified green building projects. Collected data include project name, locations, grade obtained and team information. Non-governmental organisations, civil society organisations (CSOs), consumer groups and the media can help raise awareness of the benefits of green building.

According to Umar and Khamidi (2008), cognizance on green building refers to the ideal strategic model and promotion exercise which aids people to understand why a particular issue is essential and the desire of goals and what is necessary to accomplish a task. The meaning of awareness according to Nduka (2015), is to create a base audience for a product, service or issue. Urmar and Khamidi (2008) suggest that advertisement on radio stations and TV, website development specifically for green building campaigns, media relations in terms of articles, news release and community relation by creating show participation are key tools in communicating the green building certification tool.

2.9.1.4 Time

Time is an indispensable element in the diffusion process. The adoption curve is S-shaped. This means reliant on when they accept an innovation, individuals are assembled into innovators (those who adopt at the earliest times), early adopters, early majority, late majority and laggards (those who never adopt) (Rogers, 2003). Since innovators are the first to adopt their concept, their adoption decision is not influenced by others. Early adopters are often respected by their communities and have a greater influence on people to motivate them to adopt this innovation. Laggards are the last ones to adopt it. Many a times they lack financial resources to adopt the innovation but eventually give in when the cost of not adopting becomes high.

2.9.1.5 Social System

Rogers (2003) defined a social system as a set of interconnected units that are involved in combined problem solving to achieve a goal. These interrelated units of a social system may be individuals, informal groups, organisations associations or institutions.

Each unit can be distinguished from other units in a form of a social structure. Social Structure (individuals, informal groups, organisations associations or institutions) in a social system is defined as the patterned schedules of units. Rogers (2003) postulates that a social system forms a border within which an innovation diffuses. Therefore, the social structure of a social system can facilitate or impede the diffusion of innovations in the system.

2.9.2 Innovative Decision Process

Rogers (2003) defines innovative decision process as the process through which an individual or a decision making unit moves from first knowledge of an innovation to actually forming an attitude toward the innovation to either making a decision to accept or reject it, to application of the new idea, and to validation of this decision. Basically this procedure involves the series of actions and choices over time through which an individual or an organisation assesses a new idea and decides whether or not to incorporate the new idea into current practice. This basically deals with the indecision that is integrally tangled in determining about a new alternative to those in usage already. Compared to other decision making, it is the alleged novelty of innovation and the unlikeliness that are in relation to the newness that makes innovation decision making idiosyncratic.

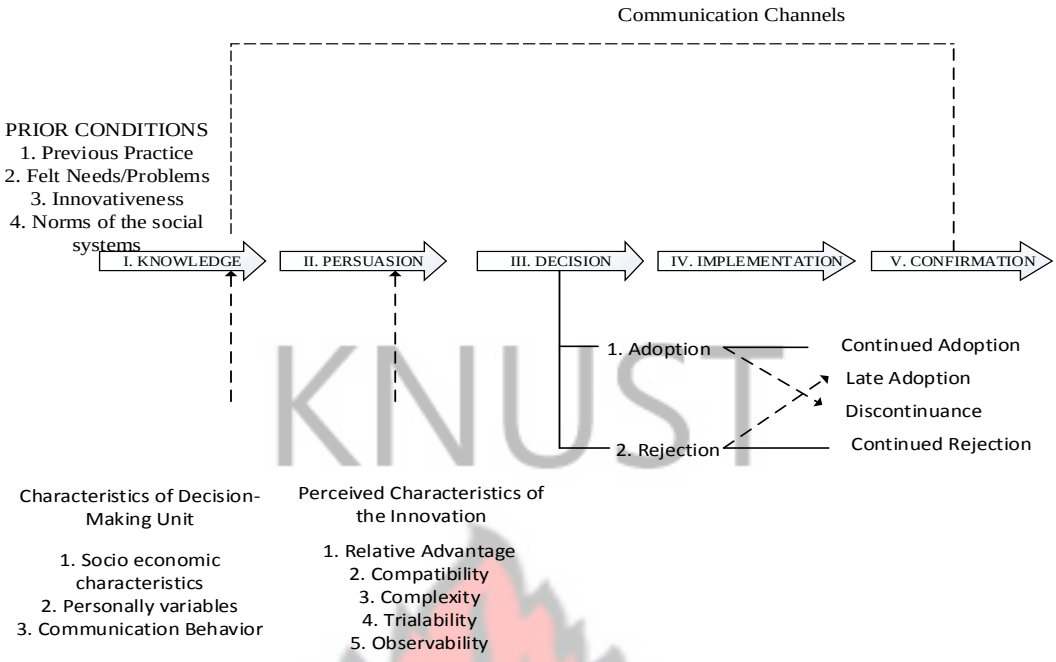

Figure 2.1 A Model of Five Stages in the Innovation-Decision Process

Source: Rogers (2003)

2.9.3 Hartman's Framework

The second framework by Hartmann (2006) proposed an outline of the innovation acceptance approaches of clients of the construction industry which depart from Roger's innovation diffusion theory. Rogers (2003) defines diffusion as the process in which a new approach or innovation is shared between identified or specified networks for a period of time among teams of a social system. The rate of diffusion is measured by a number of systems which adopts the innovation in a given period (Hartmann, 2006). Five stages of Roger's diffusion procedures are: 1) knowledge 2) persuasion, 3) decision, 4) implementation and 5) confirmation. Hartmann (2006) focused their framework on only the first three phases of Roger's (2003) diffusion process. The first step of Hartmann's (2006) diffusion process consider finding and giving out information to lessen the ambiguity about the advantages and disadvantages of an innovation. The attribute of information exchange between the teams of a social

system are seen to considerably effect the adopter behaviour of the adopter and the rate of adoption as well (Lee *et al*., 2002; Nilakanta and Scamell, 1990). Unless possible adopters know about an innovation and its conceivable importance, the innovation is improbable to be realised (Hartmann, 2006).

Knowledge of function and practice of an innovation is important to achieve a favourable approach towards an innovation (Hartmann, 2006). Communication characteristics that play a vital part in increasing the cognizance and creating awareness of innovation characteristics include the source, the mode and the worth of communication (Mohr and Spekman, 1994). The sources of information covers stakeholders such as clients, suppliers or business partners, independent third parties such as government agencies or research institution and personal sources such as friends or near peers (Souitaris, 1999).

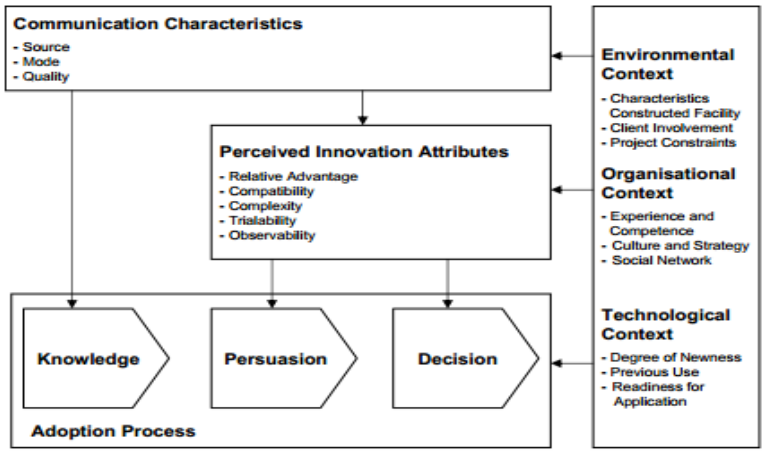

Figure 2.2 Framework of the innovation adoption process of construction clients

Source: Hartman (2006)

2.9.4 Conceptual framework for the current study

Miles and Huberman (1994) defined a conceptual framework as a visual or written product, one that explains, either graphically or in narrative form, the main things to

be studied, the key factors, concepts or variables and the presumed relationships among them. The most productive conceptual frameworks are often those that bring in ideas from outside the traditionally defined field of your study or that integrate different approaches, lines of investigation, or theories that no one had previously connected. Conceptual frameworks possess ontological, epistemological, and methodological assumptions, and each concept within a conceptual framework plays an ontological or epistemological role (Jabareen, 2009). The ontological assumptions relate to knowledge of the "way things are", "the nature of reality", "real" existence, and "real" action (Guba and Lincoln, 1994). The epistemological assumptions relate to "how things really are" and "how things really work" in an assumed reality.

This study focused on the innovation diffusion framework proposed by Roger (2003) which defines innovation as an idea, practice, or project that is perceived as new by individual or other units of adoption. Goodrum and Haas (2000) postulates that one of the key success in the construction industry is having the ability to innovate. There have been innovations recognized by the Architecture Engineering and Construction (AEC) industry including Building Information Modelling (BIM) (Azhar et al., 2008), green building products and technologies (Lippiatt, 1999) and green building guidelines and assessment systems (Portbhare *et al.*, 2009a). The environment within which the construction industry exist is periodically undergoing transformation (Ofori, 2012) and the only means for a construction industry to survive in this complex and changing environment is through innovation (Steele and Murray, 2004). Therefore, the proposed research framework postulates that identifying green building certification as an innovation as well as recognizing the drivers that motivate individuals to adopt this innovation can enhance the implementation and adoption quickly.

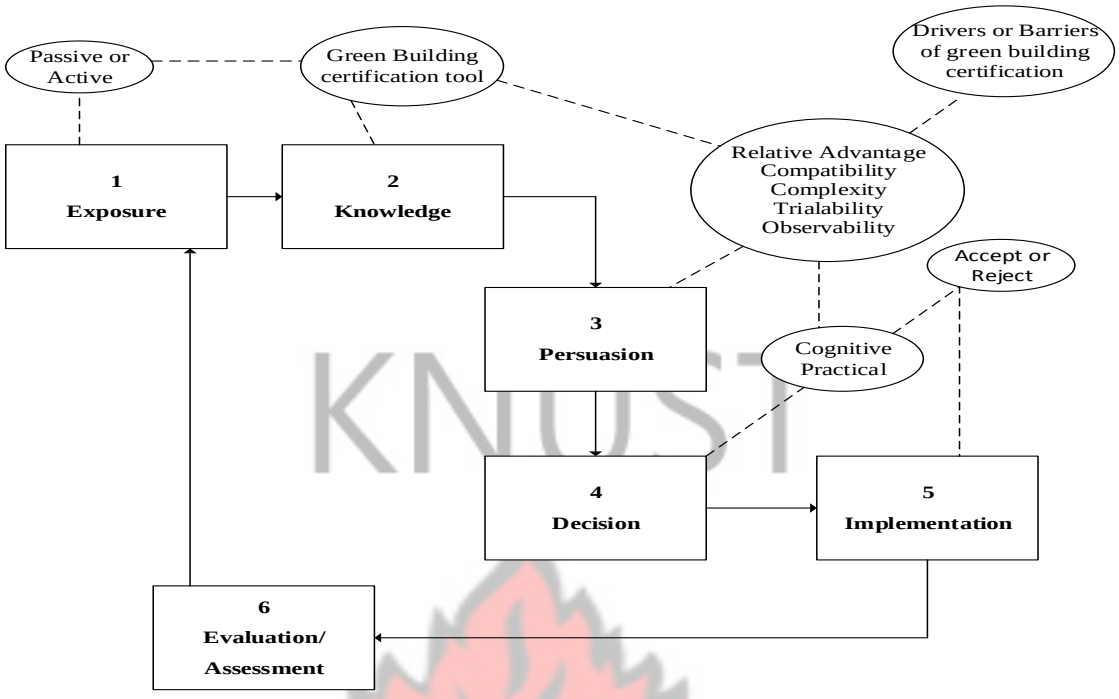

Figure 2.3 Green Building Certification Framework

Source: Author's construct, 2017

2.9.4.1 Exposure Stage

Roger (2003) argued that an individual plays an unreceptive duty in being exposed to knowledge about an innovation. Also, it has been claimed that one become aware of an innovation mostly by chance as one cannot aggressively seek an innovation until one attests that it exists. Coleman *et al.* (1996) concluded that preliminary facts about a new medical drug mostly occurred through salespersons and advertising that physicians did not seek but later on these doctors become active information seekers. This affirms that individuals would only gain knowledge about green building certification either through active means or passive means. A firm or an organisation may want to improve their method of designing or construction that would improve their corporate image or put them ahead of their competitors. A client may also want a building which has energy efficient features so as to reduce the cost of operating the building. The organisation or the client would then actively seek for information that can satisfy their requirements. Therefore, an active search for information is normally

preceded by a need which has to be satisfied. A passive search for information also leads to information seeking but it is stumbling upon an information which the individual had no intention of searching for. Roger (2003) further states that individuals tend to expose themselves to ideas that are in accordance with their interests, needs, or existing attitudes. We consciously or unconsciously avoid messages that are in conflict with our predispositions. This according to Roger (2003) is known as selective exposure. Hassinger (1959) contends that individuals slightly expose themselves to innovation unless they primarily see the necessity for the innovation, and even if such persons are open to these messages of innovation, such experiences will have slight effects lest the person sees the innovation to be pertinent to his needs and as reliable with his prevailing attitudes and principles. A need, according to Rogers (2003) is a state of discontent that happens when one's wishes overshadow one's facts, or when "wants" outpaced "gets". A person may develop the need when he is of the knowing that an innovation exists or an existence of innovation may lead to a need.

2.9.4.2 Knowledge Stage

The second stage of the conceptual framework answers questions like "Where can information be found?", "What is the green building certification system?", "How does it work?", "Why does it work?". These questions are important once a person or an organisation is aware that an innovation exists. According to Roger's theory, the *How-to knowledge* consists of information necessary to use the innovation (green building certification tool) properly. In an instance where the innovation is more complex, the would-be adopter will need more time and understanding as compared to less complex ideas. If the would-be adopter does not get satisfied with the amount of knowledge obtained then, there will be rejection.

Chang *et al.* (2016), lack of database and knowledge of green building certification systems are seen as the main obstacles in adopting the certification scheme. The would-be adopter would also seek for information underlying how the innovation (green building certification) works. The theory further states that knowledge of innovation is very different from its implementation because most people know about a lot of new ideas which they have not accepted. This is because an individual's knowledge on an innovation may not necessarily be relevant to his situation, as discussed earlier on about passive form of exposure to knowledge.

2.9.4.3 Persuasion Stage

This is the third stage in the framework where the would-be adopter forms an attitude towards the green building certification either favourably or unfavourably. At the persuasion stage the would-be adopter actively seeks information about the new idea. The would-be adopter actively seeking for more information would be concerned about *where* the information is gotten, *what* message he receives, and *how* he can interpret the information received. From Roger's Diffusion Theory (2003), all novelties have some degree of unlikelihood for the individual, who is uncertain of the outcomes of the innovation and needs a strengthening of his assertiveness towards the innovation (green building certification tool). Messages from the media are too broad to consider it for the kind of strengthening needed for confirmation. The most ideal place to get the needed reinforcement is from the database of the GhGBC which at the knowledge seeking stage, the would-be adopter would have realized that there is a body that regulates the green building certification tool and green building itself.

At this stage, the would-be adopter would seek for knowledge concerning the consequences of adopting the green building certification tool. These consequences

can be likened to the barriers of green building certification tool. The would-be adopter also seeks to identify the advantages (drivers) that the certification tool would bring to the building project. Roger (2003) further states that the would- be adopter can be motivated to adopt the innovation if they seek the subjective opinions from individuals who have actually used this innovation. Therefore, the green building certification tool can be adopted by the would-be adopters if they can interact with the people who have actually used the particular certification tool and has been convinced to using them. It becomes much easier and convincing to adopt when an individual who is advocating for the usage of an innovation has actually used it.

2.9.4.4 Decision

This is the stage where the would-be adopter may mentally apply the green building certification to his present situation. According to Roger (2003), the ability to think hypothetically and counter-factually to project into the future is an important mental capacity at the persuasion stage. The would be adopter may also decide to apply this green building certification tool probationary on a building project and record how it works whether it has been of any benefits to him or the organisation.

Also at the decision stage, the would–be adopter engages in activities that can lead to a choice either to adopt or reject it. According to Rogers (2003), adoption is a decision to make full use of an innovation as the best course of action available. Rejection is a decision not to adopt an innovation. Most individuals will adopt an innovation without probationary trying it to determine its usefulness in their situation. Most individuals who try an innovation can make a decision to adopt it if there is a degree of relative advantage.

2.9.4.5 Implementation Stage

Implementation stage occurs when an individual puts an innovation into use. There is a difference between the decision to adopt green building certification tool and the decision to put it into use. At this stage, the would-be adopter seeks for answers on questions like Where do I obtain the green building certification tool"? "How do I use it?", "What operational problems am I likely to encounter?", "How can I solve them"? If the would-be adopter is an organisation, then a number of individuals are usually involved in the innovation-decision process and the implementers are normally different set of people from the decision makers.

2.9.4.6 Evaluation

This is the final stage in the framework where the organisation or the adopter after implementing the green building certification tool would assess the benefits and consequences of this innovation. At this stage a decision would be made based on the evaluation result whether to discontinue the usage of the certification tool or put in place more measures in order to ensure its continual usage.

2.10 CHAPTER SUMMARY

This chapter presented a review of green building certification systems as well as the various green building councils. It further reviewed the barriers to and drivers of green building certification and highlighted on the role of government in the promotion of green certification of buildings. Lastly, the chapter outlined the theoretical and conceptual framework underpinning the research. The conceptual framework for the implementation of green certification of building was then developed based on frameworks developed by Hartman (2006) and Roger (2003).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the background and reasoning behind the chosen research methodology. It also discusses the various steps undertaken in achieving the objectives of the study. This chapter also includes the selection and justification of the choice of research philosophy, techniques and methods used and data collection, analyses and interpretations.

3.2 PHILOSOPHICAL CONSIDERATIONS

Research philosophy relates to a set of beliefs that guides and dictates how research is conducted and how the results from analysis should be interpreted (Creswell, 2009). According to Easterby-Smith *et al*. (2002), the absence of an underlying research philosophy will negatively affect the quality of the output of the research in question. Pathirage *et al*. (2005) affirmed that it is impudent to conduct a study without a consideration of the philosophical assumptions for the study. Saunders et al. (2009) further indicated that these philosophical assumptions underpin the research strategy and methods chosen by a researcher. Research philosophy explains the epistemological, ontological and axiological assumptions upon which a research is undertaken. Epistemology is how knowledge can be created, acquired and communicated (Scotland, 2012). According to Saunders *et al*. (2009), positivism and interpretivism are the two main epistemological considerations in research.

Positivism as described by Saunders *et al.* (2009) considers data on resources needed just as a natural scientist. In positivism the researcher gathers and analyses facts. Also, the process of data collection is external to the researcher and therefore the substance

of the collected data is not altered (Saunders *et al.*, 2009). Another essential feature of the positivist position is that the study is in a value-free way (Saunders et al., 2009). Thus, the decision of what to study, and how to study it can be determined by an objective criterion instead of human beliefs and interests (Holden and Lynch, 2004). The interpretivist position of research is that phenomenon based on the interpretation of peoples' convictions (Walliman, 2003) cited in (Ahadzie, 2007). In the interpretive research, the researcher is part of the research process (Ahadzie, 2007). An interpretivist provides insight into understanding a behaviour and explains actions from the perspective of the participant (Scotland, 2012). Bryman (2004) highlighted that the researcher is engrossed in the situation of the research and values and the beliefs of the researcher become the driving force in the interpretation of the findings. This study adopted the interpretivist approach because it intends to interpret the responses of people's convictions.

Ontology is the nature of reality (Saunders *et al*., 2009). Subjectivism and objectivism are the two aspects of ontology *(*Saunders *et al*., 2009). In the world of an objectivist, the existence of reality is external to the social actors whereas the subjectivist posits that social phenomena are created from the actions and perceptions of the social actors. In view of this, the objectivist view leans towards the positivist philosophy whereas the subjectivist view leans towards the interpretivist philosophy. The subjectivism philosophy was adopted from the ontological level.

The aspect of philosophy that studies the judgements about value is Axiology. Saunders *et al.* (2009) argues that for a researcher's results to be credible, their own values have a role to play in all stages of the research. According to Heron (1996), the skills of the researcher is demonstrated axiologically when their values are the basis

for making judgements about the research or studies that they are conducting. Saunders *et al*. (2009) further iterates that the choice of your philosophical approach adopted for the study reflects your values and data collection method. An example given to affirm this assertion is that if a researcher conducts a research and collects data through interview, then personal interaction with respondents is of high value than views expressed through anonymous questionnaire. Axiology classifies the reality into value free and value laden (Pathirage *et al*., 2008). Value free is when the researcher's choice of what to study and how to study it is determined by objective criteria whereas value laden research is ascertained by the beliefs of human and experience or by subjective criteria (Easter-Smith *et al*., 2002). This research selected Value free axiological philosophy position since the study was determined by objectives that were set.

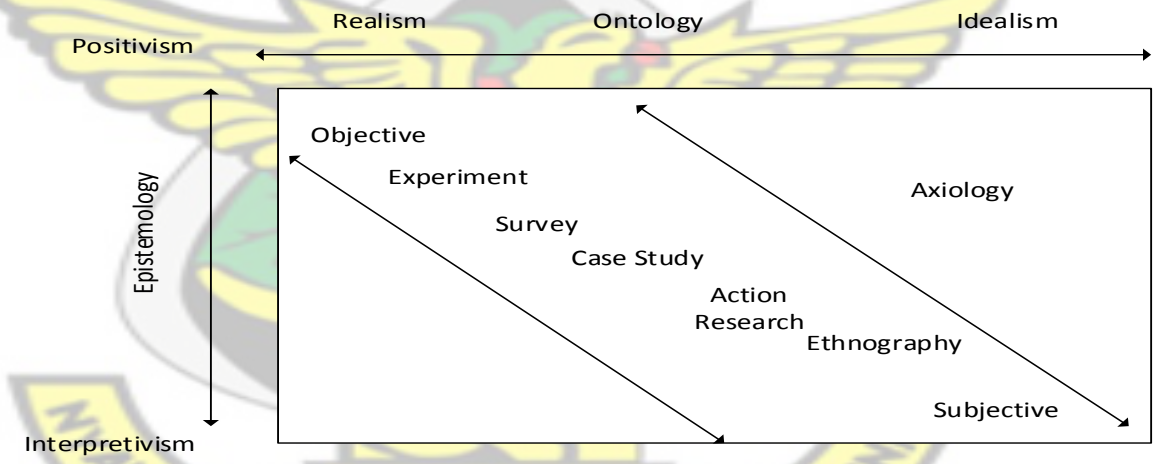

Figure 3.1 Research Philosophical Assumptions

Source: Pathirage et al. (2005)

3.3 RESEARCH APPROACH

Research approach is defined as how research objectives can be addressed (Naoum, 2007). Biggam (2008) opines that the type of approach is dependent on the drive of the study, the type and the obtainability of the required information. Dubois and Gibbert (2010) explained research approach to include inductive and deductive or abductive. Deductive approach begins with establishing a theory and identifying specific instances to which the identified theories apply (Hyde, 2000). Troachim (2006) defines the movement from the specific to general as inductive approach. Creswell and Clark (2007) also define inductive approach as bottom-up approach where the partaker's views are used to build broader themes and generate a theory.

Kovacs and Spens (2005) highlighted that the abductive approach begins with deriving theories from literature review, presenting the theory in the form of hypothesis, testing the hypothesis in an empirical setting and then drawing conclusions in line with specific instances. Linking the three research approaches to research paradigms, Jarvensivu and Tornroos (2010) indicated that positivist researchers tend to adopt the deductive research approach where the research begins with theoretical lines of reasoning. Whereas, interpretivism often uses inductive approach since it makes broader generalizations and theories from specific observations about individual occurrences (Soiferman, 2010). Realists normally have their research subject to the account of lived experiences and later inductively develop theories. An established theoretical framework was used to propose a conceptual framework which themes were applied in the collection of the data towards achieving the aim of the study. Therefore, the inductive approach was adopted for this study.

3.4 RESEARCH DESIGN

The blueprint for conducting research is identified as research design. According to Yin (2009), it defines the context within which data is collected, processed, analysed and used for the study. A research design begins with a logical problem followed by a logical structure of inquiry and ensures that the evidence obtained unambiguously answers the initial research question, and also attains the main objective of the research (Yin, 2003; De Vaus, 2001). The research design specifies the various types of research approaches which is appropriate and how the research intends to use scientific methods to augment the interpretability of the results (Polit and Hungler, 1999). The descriptive type of study was adopted because it is well-thought-out, and explicitly designed to correspond to the features described in a research question. The research design is strengthened by thematic analysis which offer appropriate triangulation tools that is used for the textual research undertaken (Zainal, 2007).

3.5 RESEARCH STRATEGY

Wedawatta *et al.* (2012) assert that the strategy for a research study suggests the overall processes used to orchestrate the research. According to Saunders et al (2009) the choice of strategy adopted for a study should be steered by the objectives, research questions to be answered, the extent of existing knowledge, the time available, and the philosophical considerations that underpinned the study. Fellows and Lui (2008) stated that the type of strategy adopted should aid in maximizing the probability of achieving the objectives for the study. Survey, action research, experiment, case study, grounded theory, ethnography and archival research are examples of research strategies (Saunders *et al.*, 2009). The selected research strategy for this study was a survey. According to Saunders *et al.* (2009) questionnaire is not the only data

collection technique used in survey strategy. However, interviews as a data collection technique can be used in survey study.

3.6 RESEARCH METHODS

Research methods refer to the techniques that researchers use in performing the operations that relate to the research (Kothari, 2011). Creswell (2003) suggested the approaches of research to include quantitative, qualitative and mixed methods. However, the study, type and information available for the research work determines the particular method to adopt (Baiden, 2006). The use of quantitative research for a study begins with data collection premised on theory or hypothesis and is followed with the application of descriptive or inferential statistics (Rajasekar *et al.*, 2013). The qualitative approach however, provides explanations of social phenomena (Hancock *et al*., 2007). Creswell (2007) defines qualitative study as a type of research method where the researcher relies on the views and judgements of respondents by asking questions and collecting data consisting of words from the respondents, describing and analysing these words for themes and conducting the inquiry in a subjective manner. This research intends to gather the words of participants and use them in a subjective manner to propose a framework for the implementation of green certification of building in Ghana. Therefore, this study used interviews as a qualitative method in collecting data from respondents.

3.7 RESEARCH INSTRUMENT

A semi-structured interview guide was used to solicit data from respondents. Qualitative research interviews may be structured or semi-structured. Unstructured interviews are conducted with the participants taking lead to a greater extent, in narrating their stories rather than the researcher directing the interview (Fossey *et al*.,

2002). Semi-structured interviews use interview guide with a list of questions outlined to direct the interview in a focused but flexible manner (Minichiello, 1990). The interview guide was designed through four stages as listed below:

- Formulate interview guide
- Conduct content validity test
- Modify the interview guide
- Use the modified interview guide for the main interview

The constructs in the conceptual framework were used as themes in the interview guide in order to collect useful and relevant data. Each response under each theme was analysed to bring out the guidelines under each construct of the conceptual framework.

3.8 TARGET POPULATION

The population of a study involves a group of individuals to which the results itself, discussion of the results and the implication of the study are to be generalized (Sampson, 2012). According to Cohen *et al*. (2005), unless the population is defined, it is impossible to authenticate the representatives of the sample (Cohen *et al*., 2005). The population of the study was professional bodies in the built environment. These bodies included the Ghana Institute of Architects, Ghana Institution of Surveyors, Ghana Institute of Construction, Ghana Institute of Planners, Ghana Green Building Council, Institution of Engineering and Technology, Ghana Real Estate Developers Association, CIOB-Ghana, and Association of Building and Civil Engineering Contractors of Ghana. Professional bodies were selected for the study because according to Roger's (2003), they are a social structure that can either promote or frustrate the diffusion of an innovation like green certification of buildings.

3.9 SAMPLE SIZE AND SAMPLING TECHNIQUE

Sampling provides the means by which data is collected from a sub-group rather than the entire population (Saunders *et al*., 2009). The purpose of sampling is to obtain a manageable size of the population for the study. The sampling techniques are divided into probability and non-probability (Fellows and Lui, 2008). Probability sampling are systematic sampling, stratified random sampling, cluster sampling and simple random sampling (Saunders *et al.*, 2009; Fellows and Lui, 2008). Non-Probability sampling techniques are quota, snowball, purposive, and convenience sampling. Choosing either probability or non-probability sampling technique dependant on the goal of the research. This study adopted a purposive sampling technique. This is because the researcher intended to select individuals that were well proficient and well-informed about the subject matter. Table 3.1 shows the criteria used to select the samples.

Table 3.1 Selection Criteria for Sample

ITEM	CRITERION	INDICATOR
1	Members of a professional body	The individual should be in good standing
2	Knowledge on green certification of buildings	The respondents will be chosen by their leaders on the premise that they have knowledge on the subject matter
3	Willingness of the professional body/ interviewee	The professional body or interviewee must be willing to take part in the study
4	Availability of the interviewee	The individual must be available to be interviewed per the scheduled date and time

To qualify to be selected, the following criteria were sought from the respondents:

1) The interviewee was required to be a member of a professional body and should be someone who is in good standing; 2) The professional body or interviewee was required to be knowledgeable on the concept of green building certification; 3) The

interviewee should be willing to partake in the interview; and 4) The nominated member of the professional body should be willing to partake in the interview. This is very crucial to the research because the interviewee would have to be available whether through a phone call, face-to-face interview or skype. The sample size for this study was 10 elected members, one from each professional body.

3.10 CONTENT VALIDITY TEST

The content validity is defined as when research instruments are reviewed by people who are knowledgeable in the research area (Zohrabi, 2013). The reviewers' comments help in revising unclear and obscure questions by rewording them. Also, non-functioning and ineffective questions can be discarded altogether. This process is important to determine that the questions asked during the interview will be reliable and capable of achieving the research objectives. The content validity of the interview guide used in this study was conducted by referring to 2 researchers in the built environment with knowledge on green certification of buildings. The aim, objectives and conceptual framework were added to the interview guide to aid in identifying the relevance of the questions in the interview guide. Table 3.2 summarizes some of the comments obtained from the reviewers which were used to improve on the interview guides.

Table 3.3 Comments from reviewers

S/N	Comments from reviewers	Modification to interview guide.
1	Originally there was no question inquiring about the incentives that can help people decide to adopt the green certification of buildings	An additional theme was added to the interview guide and was themed as stated below: **Theme 4: Decision** 13. What are some of the incentives that will make professionals decide to adopt the green certification of buildings?
2	**Theme 2** Apart from getting information from the professional body/organisation/institution, where else do you think they can get information? **Comment**: The places that they will suggest as where people can get information apart from the body/organisation/institution may not be reliable and may be biased. Information from authentic and unbiased sources makes the largest impact.	To address this comment, an additional question was added to the interview guide to seek the required details as shown below: **Theme 2** 6. Apart from getting information from the professional body/organisation/institution, which authentic place do you think information could be obtained?
	Comments from reviewers	**Modification to interview guide.**
3	**Theme 3: Persuasion** How can the mass media be effectively utilized in promoting the green certification of buildings? **Comment:** Roger (2003) identified interpersonal communication as a medium of communicating an innovation not only mass communication.	To address this comment, an additional question was added to the interview guide to seek the required details as shown below: **Theme 3: Persuasion** How can the mass media and interpersonal communication be effectively utilized in promoting the green certification of buildings in the institute /association?
4	**Theme 4: Decision** What are some of the reasons why people have not decided to adopt the green certification of buildings even after knowing the possible benefits? **Comment**: The question can be rephrased in a conditional term or probabilistic terms?	**Theme 4: Decision** 12. What do you think are the possible reasons why people will not adopt the green certification of buildings?

3.11 INTERVIEWS

The interviewees were representatives of professional bodies in the built environment; contractor association, real estate association, architect association, and engineer associations. An official letter was written to the professional bodies, asking them to participate in the research through interviews. Each professional body nominated an individual to speak on her behalf. Face-to-face and phone interviews of approximately 30 minutes to 45 minutes in length were conducted with the representatives of the professional bodies. A semi-structured interview guide was used to conduct the interview. With the permission of the interviewees, the interview sessions were recorded using a phone recorder. Follow-up telephone interviews were carried out for further clarifications in instances where questions were not answered satisfactorily.

There were three (3) sections in the interview guide; Sections A, B and C. Section A was used to gather the background information of the interviewees; 1) Professional Body/Organisation/Institution, 2) Date of Interview, 3) Position in the professional body/organisation/institution, 4) Email/Contact and 5) Years of working experience in your profession. Section B of the interview guide was divided into themes according to the constructs in the conceptual framework. Questions were asked under each theme. Some of the questions were; 1) Whether the professional body was aware of green certification of buildings, 2) Whether they recognise the importance of green certification of buildings, 3) What are the possible reasons why people will not adopt green certification of buildings? These and many other questions were asked under section B. Section C of the interview guide was labelled additional questions. This section was used ask questions that sought to strengthen the answers that were provided in Section B of the interview guide.

3.12 VALIDITY

Validity is the accuracy and truthfulness of research findings (LeCompe and Goetz, 1982). Campbell and Stanley (1966) identified internal and external validity as the major forms of validity. Burns (1999) defines external validity as the usage tendency of research findings in other settings. However, it is dependent on the basic similarities between the current context and other contexts (Zohrabi, 2013). Internal validity is the harmony between the research findings and reality. It is the degree of observing and measuring what is supposed to be measured. Merriam (1998) recommended six methods: participant feedback, longer term observation at the research site, triangulation, examination through peers and participatory or collaborative modes of research and researcher's bias. Triangulation collects data through interviews, questionnaires and classroom observations. Through the participant feedback the results and interpretations are taken back to the respondents in order to confirm the content of what they said during the interview (Zohrabi, 2013). The examination process through peers involves reviewing the comments on the research data and findings by several nonparticipants in the field who are knowledgeable about the subject matter (Zohrabi, 2013). These peers involved in the review need to be familiar with the subject under study and possess enough background information in it. Peer examination was used during this research by allowing experienced experts with knowledge on the subject matter to review and comment on the interview findings. This is because the availability of the interviewees for the interview was a challenge, where it took months before some of the interviewees made themselves available. It was therefore predicted that, that challenge could have been encountered had the participant feedback method been used for the internal validity.

3.13 RELIABILITY

Nunan (1999) defines internal reliability as the uniformity, replicability and dependability of the results obtained from a piece of research. External Reliability is the replicability of the research (Zohrabi, 2013). Burns (1999) defined external reliability in the form of a question as follows: "can an independent researcher reproduce the study and obtain similar results as compared to the original study?" Zohrabi (2013) defines internal reliability as obtaining similar findings as the original study when an independent researcher is reanalysing the information. The question that needs to be answered in order to achieve internal validity is "Would the same results be obtained by other researchers using the same analysis? (Burns, 1999). In quantitative research obtaining similar data is uncomplicated because of the numerical form of the data collected. However, because of the narrative and subjective form of qualitative data, it is difficult to obtain the same results (Zohrabi, 2013). There are four basic strategies in achieving internal validity: multiple researchers/participant researchers, low inference descriptors and mechanically recorded data and peer examination (LeCompte and Goetz, 1982). In order to ensure that the same results would be obtained by other researchers, the interviews were recorded and preserved. The procedure for collecting the data was described in detail, how they were analysed, the derivation of different themes and how the results were obtained were also described in detail. Therefore, replication of the data can be easily implemented by an independent investigator

3.14 ETHICAL CONSIDERATIONS

Before the interviews the respondents were introduced to confidentiality clause. The interviewees were informed about the following;

- The interview was solely for academic purposes
- The purpose of the study was communicated to them
- The information about the respondents will be confidential and made anonymous in the write-up

The identity of the professional bodies was replaced with code names in order to protect the confidentiality of the respondents. For ease of clarification, the professional bodies were named as shown in Table 3.4.

Table 3:4 Professional Bodies and their Code names

Professional Body	**Coding**
CIOB-Ghana	Professional Body 1
IETG	Professional Body 2
GREDA	Professional Body 3
GhIP	Professional Body 4
BRRI	Professional Body 5
GhIS	Professional Body 6
ABCECG	Professional Body 7
GhGBC	Professional Body 8
GIA	Professional Body 9
GIOC	Professional Body 10

3.15 DATA ANALYSIS

In analysing qualitative data, there are several analytical tools viable for the researcher to use. These tools are content analysis, grounded theory, data matrix analysis and thematic analysis (King, 2004). This study used thematic analysis to analyse data within the specific themes in view of the meanings attributed to these themes. The data

was analysed by coding using Nvivo 11 software. Nvivo software was used because it is an effective manager of text as well as analysis. Coding is the process of gathering data by themes or cases in Nvivo. An example is selecting a paragraph about water quality and coding it at the theme node 'water quality' (QSR International, 2017). The data collected during the interview were analysed using the following procedure:

1. The recorded data in a form of audio was transcribed using MS Word 2017.
2. Each of the interviews with the professional bodies were transcribed separately in a word document and saved in their respective names.
3. The transcribed data were cross-checked with the audio recordings to ensure that they were exactly the same as the audio recordings from the interview.
4. The transcribed data were imported into the Nvivo 11 Pro.
5. Deductive approach of thematic analysis was used. The themes in the interview guide were coded in new nodes. Node allow you to gather related material in one place so that you can look for emerging patterns and ideas.
6. Responses from all the interviewees were grouped under their respective themes or nodes
7. The responses under each node (themes) were coded separately and analyzed.
8. The coded data were discussed and supported with literature in order to give meaning to the results.
9. A word frequency was run to identify the frequently occurring words. The larger the words, the more frequently it appeared in the responses of the interviews.

3.16 CHAPTER SUMMARY

This chapter discussed the research methodology used in conducting this study. It highlighted on the procedures used in preparing for the data collection and how the data was analysed using Nvivo11 Pro. The subsequent chapters are used to discuss the analysed data and give conclusion and recommendations based on the findings.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

Previous chapters were used to introduce the study, review relevant existing literature and the research methodology adopted for the study. This chapter presents the findings obtained from the semi-structured interviews and analysis of the results. Discussions of these findings indicated the level of knowledge of built environment professionals on green certification of buildings in Ghana. The various barriers, drivers and challenges were also identified in the adoption of green certification of buildings. The responses from these professional bodies were used in proposing a framework for the implementation of green building certification in Ghana.

4.2 THEMATIC ANALYSIS

Thematic analysis is used for identifying, analysing and reporting patterns (themes) within the data (Braun and Clarke, 2006). Thematic analysis allows either deductive or inductive methodologies to be used in analysis (Frith and Gleeson, 2004; Hayes, 1997). Deductive thematic analysis uses predetermined themes and produces an initial classification. The themes used in the analysis of this study were predetermined before the data collection. Sub-themes emerged from the data collected. According to Braun and Clark (2006), a theme captures something significant about the data in relation to the research question and represents some meaning or level of patterned response within the data set.

4.3 CHARACTERISTICS OF RESPONDENTS

Letters were written to these professional bodies to nominate a representative who is knowledgeable on green certification of buildings to speak on their behalf. The selection criteria used were that: 1) The person should be a member of a professional body, and must be in good standing as at the time of being nominated; 2) the person had to have knowledge on the subject matter; 3) the person had to be willing to take part of the study; and 4) the person had to be available for the interview. In all, a total of ten (10) representatives from the professional bodies were interviewed. Table 4.1 provides a summary of the characteristics of the respondents.

Table 4.1: Characteristics of Respondents

No	Professional Body	Position in the Professional Body	Years of working experience	Mode of interview
1	CIOB-Ghana	Member	8 years	Face-to-face
2	IETG	Member	8years	Face-to-face
3	GREDA	Secretary	18 years	Phone Call
4	GhIP	President	15 years	Phone Call
5	BRRI	Research Assistant	20 years	Face-to-face
6	GhIS	Council Member	20 years	Phone call
7	ABCECG	President	45 years	Phone call
8	GhGBC	Member	30 years	Phone call
9	GIA	Member	25 years	Phone call
10	GIOC	Member, Lecturer	15 years	Face-to-face

4.4 THEMATIC DISCUSSION OF RESULTS

The results have been presented and discussed in the various themes as used in the interview guide, and further presented under the individual objectives.

4.4.1 Theme 1: Exposure Stage

4.4.1.1 Awareness of Green Certification of Building

The meaning of awareness according to Nduka (2015), is to create a base audience for a product, service or issue. According to SmartMarket Report (2016), lack of public awareness is one of the top obstacles in many developing green markets. Also, Umar and Khamidi (2008) asserts that awareness on green building certification refers to ideal strategic model and promotion exercise which aids people to understand why it is important to implement green certification. Without client and customer awareness of the potential benefits of green building certification system, it will be difficult for them to exhibit interest and consequently demand for them (Darko and Chan, 2016). The following views were presented by some of the professional bodies with regards to their awareness on green building certification:

"The association is aware of green certification of buildings. There have been some engagements to sensitise members. The greatest awareness was when the Danish embassy visited the association in 2015 to inform us about a green building exhibition that some members attended (Professional Body 3).

"They are aware of green certification of buildings. The professional body is made up of different professions and there are some who have had continuing professional developments (CPDs) on green building but not necessarily green certification of buildings" (Professional Body 6)

"We recognise its importance. That is what our organisation represents and that is what brought all of us together" (Professional Body 8)

"The Institute is aware of green certification of building. Some of the architects are part of the team that certified the one airport square" (Professional Body 9)

This demonstrates how some professional bodies were using their influences and platform s to promote the green certification of building. However, some professional bodies responded that they have not discussed the green certification of buildings with their members. Though they said that some of their members might have heard about it elsewhere:

"the Institute as a body is not necessarily aware of the green certification of buildings. However, as an institute we have plans of incorporating it into our agenda in the future" (Professional Body 2)

"the Institute as an entity is not aware of green certification of buildings neither has there been any collaborations with any external institutions or body on the subject matter. However, we will be considering it in the future" (Professional Body 4)

4.4.1.2 Importance of Green Certification of Buildings

Professional bodies were asked if they recognise the importance of green certification of buildings. Some of them acknowledged that they know its importance through seminars, trainings etc. Though they recognise its importance some of them have not made the effort to train their members on them. Below are some of the responses from the professional bodies.

"The association recognises the importance of green certification of buildings. One of its guiding principles is to deliver a built environment that is responsive to the

changes in the environment by making sure that buildings attain green status" (Professional Body 1).

*"The institute recognises the importance of green certification of buildings (*Professional Body 3, Professional Body 7, Professional Body 8, Professional Body 9)"

4.4.1.3 Frequency of members being encouraged to adopt green building certification

Respondents were asked if members were encouraged to adopt green certification of buildings and the medium that they used. This was to identify their commitments to promoting it.

"*For each issue of our monthly magazine there is something about green building certification. That is a monthly magazine, members get both online and print copies of the monthly magazine. Green building products are also advertised in these monthly journals. We also get academic journals once every year which covers issues on green certification of buildings"* (Professional Body 1)

"Members are encouraged but we are still at the awareness stage. Some of the developers might *have unknowing*ly *adopted green building methodologies not because they were compelled to do so. We are still sensitizing our members. There is a software called EDGE that International Finance Corporation is introducing to us through the SGF, which members apply on their projects. At the design stage you will be able to make input into the software about the size of your door, roof, windows and others that will be able to generate the energy consumption and the green effect. The edge product has been designed in a way that you should have a minimum of 20% of energy savings, therefore if it goes below the 20%, then it will prompt you that your*

design is not designed to the green standards and hence, you may have to re-visit your design and make certain changes in order to reach that 20% for you to be qualified to be certified"

All members are encouraged to incorporate green since that is what they stand for (Professional Body 8)

4.4.2 Theme 2: Knowledge Stage

4.4.2.1 The need for Intensified Training

Knowledge and experience on green building projects are necessary for improving environmental performance of buildings (Li *et al*., 2014). In this stage interviewees were asked if there is the need for more education and training as Hammer *et al.* (2011) asserts that the development of green building certification hinges on the availability of skilled and trained people to fill the emerging green jobs.

"There is the need for members to be educated more. Because much of the education is from other countries with no bearing in Ghana, some of the things we read in the journal seem abstract. Some of these information is advanced and not suitable for Ghana. Currently there are no practical steps that locally everybody can follow to ensure that a building gets a green certification" (Professional Body 1).

*"Definitely there are people who will read about it individually or those who are inquisitive will want to read more. Therefore, not everybody knows about it. There is the need for more education on this, especially by using the institute's platform" (*Professional Body 2)

"There is the need for more education. With the Edge software for instance, apart from having a larger platform to educate members, there will be the need for

*companies to be visited individually and educated more on it. There is the need for clients to be educated and appreciate the benefits of green certified buildings though it might cost a bit higher than the conventional buildings its lifecycle benefits are worthwhile" (*Professional Body 3*)*

Of course there is the need for more education. The concept is there but application is the challenge (Professional Body 5, Professional Body 7, Professional Body 8).

*There is the need to train professionals, especially in commercial buildings or developments that are for investments. Where the property is going to be commercial, foreign clients for instance, will be concerned about certifying the buildings, therefore, there would be the need for people to be trained on how to build as such (*Professional Body 6*).*

"There is the need for more intensified education. Our ultimate is to have it included in the curriculum of the students who will eventually become members of our professional body" (Professional Body 9).

4.4.2.2 Knowledge on how green certification of buildings work

It was imperative to enquire if these professional bodies have trained their members on particular green building certification systems or tools. Therefore, questions were asked to elicit the various certification systems that members have been trained on and how it was conducted. According to Hakkinen and Belloni (2011) green certification of building can be hindered by ignorance or a lack of common understanding. Sodagar and Fieldson (2008) asserts that in order to design a building according to a certification system, the design team needs to have access to the best available information on products and tools. However, there is lack of access to knowledge and

materials, especially in countries where certified green building is lagging (Choi, 2009).

"Members know how this green certification of building works generally but not in the context of the Ghanaian construction industry. There has been two CPDs on green building certification. The first one was from other countries like expatriates from developed countries who are undertaking projects here in Ghana. These expatriates taught us about green certification of building. An external consultant who was not a member of our association but has experience on green certification of building carried out this task. This green certification of buildings is best suited for more organised contractors" (Professional Body 1).

"Some do know how it works, especially those who were part of the team that certified the one airport square" (Professional Body 9).

Some of the professional Bodies admitted their members do not know how it works because they have not trained them concerning the green certification of buildings.

"As a group we have not had trainings about green certification of building" (Professional Body 2, Professional Body 4, Professional Body 5, Professional Body 7)

4.4.2.3 Source of information on green certification of buildings

Diffusion is a particular type of communication in which the information that is exchanged is concerned with new ideas (Rogers, 2003). Interviewees were asked to identify sources of information that they deemed reliable for the communication of matters concerning green certification of buildings. Potbhare *et al*. (2009) established that the availability of better information is the most essential incentive to stimulate

the adoption of green building certification. In order to ensure the widespread of this innovation the "information barrier" needs to be resolved in advance. This information can be distributed to society through the print media, radio programs and television shows (Darko and Chan, 2016). The views of some of the professional bodies concerning where they obtain information on green certification of buildings is presented below.

"Our monthly issue of magazines, gives us links to sites or organisations that talk about green certification of buildings. Our professional body connects us to official documents on green certification of buildings from different governments. An example is BRE whose link was in one of our journals so then, if you are interested, you can click and read more about them" (Professional Body 1)

The energy commission, GhGBC, Ghana Standard Authority, Other professional Bodies in the built environment, TV, magazines can be used as a medium of communication" (Professional Bodies).

In a study conducted by Cheng and Ventaraman (2016) to analyse the relationships between project team compositions and green building certification in green building projects, the project team information of all LEED certified buildings were collected from the Canadian Green Building Council (CaGBC) database. According to Cheng and Ventaraman (2016), the CaGBC database was selected to conduct the analysis because it provided accurate project information of certified green building projects. A dedicated website like the website for GhGBC can serve as database for reputable, current and standardized green building data which may be useful.

4.4.4.4 Knowledge on any green building certification tool

Interviewees were asked to mention any green certification tool that they were familiar with. Some of the responses shown below demonstrate that these professional bodies have exposed their members to Green Star Sa-Ghana which was developed by the Ghana Green Building Council.

BREEAM, LEED (Professional Body 1)

What we know is called the Edge software (Professional Body 3)

During our last CPD there was presentation from Edge and we were directed to their website to read more about it. Magazines, Green Building Code (Professional Body 5, Professional Body 6, Professional Body 7)

As a professional body we have not been exposed to any of the green certification system (Professional Body 4)

Green Star (Professional Body 9).

4.4.4.5 Complexity of green certification of buildings

According to Rogers (2003), complexity is the degree to which an innovation is perceived as being difficult to understand and use. New ideas that are simpler to understand will be adopted more rapidly than innovations that require the adopter to develop new skills and understandings.

"It is difficult to identify clearly what you need to do to get certified. We have not been educated on how to get certified in Ghana. The objective of what we are being taught is to help us so that individually we could incorporate some of the green principles but not to attain certification" (Professional Body 1)

"Based on the seminars and workshops we had on Edge Certification that our professional body have had, it is not complex but requires comprehensive data to be fed into the software which is time consuming" (Professional 3)

"It is not complex but you need expertise. The edge that the world bank is financing is simplified which covers only 3 areas of the 9 categories of green certification" (Professional Body 8 and Professional Body 9)

4.4.3 Theme 3: Persuasion Stage

4.4.3.1 Effective Communication of Green certification of Buildings

Communication is the process by which participants create and share information with one another in order to reach a mutual understanding. Diffusion is a particular type of communication in which the information that is exchanged is concerned with new ideas (Rogers, 2003). Interviewees were asked to identify how mass media and interpersonal communication can be used to effectively communicate the green certification of building. Urmar and Khamidi (2008) suggest that advertisement on radio and TV stations, website development specifically for green building campaigns, media relations in terms of articles, news release and community relation by creating show participation are key tools in communicating the green building certification tool.

"*FM and TV stations can be effective ways of communicating green certification of buildings. TV media can be invited during seminars or workshops to communicate it to the general public"* (Professional Body 1, Professional Body 2, Professional Body 3, Professional Body 4, Professional Body 5)

There was also a concern about inadequate funds to use mass media as a medium of communication. An interviewee noted that, the amount of money required to use the

media as a medium of communication deters them from taking this initiative.

"The problem with the media is that everything you would want to promote; you have to pay for them. Being a voluntary organisation, there are no funds for that. The funds we have are member-generated which is not enough. It was during the launch of the one airport square and the Eco-build that the media captured them. The media does not provide free services in Ghana. Anytime we get the chance to be on TV we are also not given that opportunity to fully discuss matters on green certification of building.

4.4.3.2 Observability of Benefits of green certification of Buildings

Chigona and Licker (2008) assert that abstract or ambiguous innovations are generally difficult to adopt and its diffusion becomes very slow. The Ghanaian society can better appreciate green building certification if the benefits of adopting them are visible for the would-be adopters to know how feasible that is. An example is that companies will demand green buildings if it can be demonstrated that the superior indoor environment quality results in improvements to staff health, staff satisfaction and staff productivity (Wilson and Tagaza, 2006).

"People need to see the benefits of green building as a means of motivating them. This one airport square building in Accra which is certified needs to be marketed in the media and the benefits must be made known to the masses of people" (Professional Body 2).

"The benefits must be communicated efficiently. Models should be developed so that people can appreciate the benefits. Design both conventional building and green building and then do simple costing. Then you do cost benefit analysis. How much is it costing you today and how much will it be costing you over a period of time" (Professional Body 3.)

"People need to see the benefits of green building as a means of motivating them to adopt the green certification of buildings" (Professional Body 4, Professional Body 5, Professional Body 7, Professional Body 8, Professional Body 9).

4.4.3.3 Active Participation of government

Koski and Lee (2011) asserts that governments can certify their buildings whereas creating specialists in green buildings such that availability and expertise of architects, construction firms and building materials increase. Government and local authority organisations that develop public buildings may affect significantly the development of green certification of buildings if they decide to adopt it (Hakkinen and Belloni, 2011). Some of the interviewees said they have not seen the government's commitment unlike other countries where they have pledged their support. Also there were concerns about the sustainability of the government's commitment.

"The government has done a bit more about environmental issues and conservation of energy but is not in the name of green certification. Energy conservation and environmental is one aspect of green" (Professional Body 3)

"Government mostly provide the short term need of the people instead of the long term needs. Initially, they might give you the support but they may not give us the necessary push. What the politician is interested in are policies that will give them an immediate score" (Professional Body 2)

"The government's interest is low. If their interest were to be high, then we wold have all joined in" (Professional Body 7)

"There is no visible government support in green certification of buildings" (Professional Body 4)

4.4.4 Theme 4: Decision Stage

4.4.4.1 Barriers to green certification of buildings

a) Lack of legal Backing

A key factor is facilitating the rate of adoption and implementation of green certification of buildings is the systematic imposition of legal regulations that ensures that individuals follow best practices (Wiafe, 2016).

"No legal backing to make it mandatory for people to certify their buildings to be green" (Professional Body 1, Professional Body 5, Professional Body 7 and Professional Body 8)

b) Cost and Financing

The fear for higher investment costs of green building compared to traditional building and the risks of unforeseen costs are perhaps the most commonly addressed barriers for green buildings (Hakkinen and Belloni, 2011). Some respondents also mentioned cost as a major barrier that could deter people from adopting it.

"Cost and financing are the biggest challenges in deciding to adopt the green certification of buildings, but Special Mortgage incentives as green building incentives can motivate people to adopt the green certification of buildings" (Professional Body 3, Professional Body 6, Professional Body 8)

Lack of investment (Professional Body 8, Professional Body 9)

However, Bartlett and Howard (2000) also agree that cost consultants have been overestimating the capital costs of energy efficient measures and underestimating the potential cost savings. Hydes and Creech (2000) assert that higher costs may also come

from the design team and contractors due to their unfamiliarity with green building methods.

c) Inadequate awareness of the benefits of green certification of building

Without client and customer awareness of the potential benefits of green building certification system, it will be difficult for them to show interest and consequently demand for them (Darko and Chan, 2016).

"Lack of understanding on life cycle cost and benefits of green buildings and conventional buildings" (Professional Body 6, Professional Body 8)

d) Inadequate human resource

The development of green building certification hinges on the availability of skilled and trained people to fill the emerging green jobs (Hammer *et al*., 2011). According to United Nations Environment Programme (2008), shortage of skilled labour could bring to halt the green building.

Fear of inadequate trained assessors (Professional Body 4)

e) Lack of active government participation

Koski and Lee (2014) identifies governments as the most visible members of the regulated community although they are often scrutinized for their actions. According to Landman (1999), the responsibility for learning, educating, demanding and implementing more sustainable or green practices depends on the government rather than the private sector.

The government does not show enough commitment (Professional Body 1, Professional Body 4, Professional Body 7, Professional Body 9)

f) Conservative Nature of Ghanaians

Some of the interviewees asserted that Ghanaians are acclimatised to the way they do their things on a normal basis. This becomes a barrier when an innovation is introduced, it becomes difficult to convince people to do away with what they are used to and accept something new.

"Social acceptance of new technology like green certification of buildings (Professional Body 2, Professional Body 3)

4.4.5 Theme 5: Implementation

4.4.5.1 Drivers of green certification of building

a) Observability of the benefits of the green certified buildings

For the data gathered from the interviews, these professional bodies were of the view that people needed to see the benefits of the green certification of building as a means of motivating people to adopt it. The Ghanaian society can better appreciate green building certification if the benefits of using the certification system on the few green buildings are visible for the would-be adopters to know how feasible that is. Chigona and Licker (2008) assert that abstract or ambiguous innovations are generally difficult to adopt and its diffusion becomes very slow. This was evident in the interviewees' comments below:

"People need to see the benefits of green building as a means of motivating them. This one airport square building in Accra which is certified needs to be marketed in the media and the benefits must be made known to the masses of people" (Professional Body 2)

This is similar to the argument that Darko and Chan (2016) raised that without client and customer awareness of the potential benefits of green building certification system, it will be difficult for them to show interest and consequently demand for them.

b) Commitment of Government

Koski and Lee (2014) identifies governments as the most visible members of the regulated community although they are often scrutinized for their actions. According to Landman (1999), the responsibility for learning, educating, demanding and implementing more sustainable or green practices depends on the government rather than the private sector.

"It should be incorporated into the educational system. Also the government should introduce "certification as governance". Furthermore, corporate clients like banks, academic institutions and hospitals should enforce it on the contractors that they want their building to meet the green certification standards" (Professional Body 1)

"The government should certify public buildings like, community schools, District Chief Executives bungalows, district assembly halls where people normally converge (Public buildings as demonstration) can help" (Professional Body 2).

This supports Koski and Lee (2011) assertion that governments can certify their buildings whereas creating specialists in green buildings such that availability and expertise of architects, construction firms and building materials increase. Governmental and local authority organisations that develop public buildings may affect significantly the development of green certification of buildings if they decide to adopt it (Hakkinen and Belloni, 2011).

c) Incorporating it into the code of practice of professional bodies

It was made clear from the interviewees that the professional body can help in promoting the green certification of building by incorporating it into their code of practice so that if any member would want to rise through ranks in the association it will be tied to your commitment to green certification of buildings one way or the other.

"Professional bodies should incorporate this green certification of buildings in their code of practice as a means of admonishing members to adopt this green certification of buildings." (Professional Body 4).

d) Green Building Certification Incentives

Sayce *et al*. (2007) and Lam *et al.* (2009) suggest that one of the obstacles in the adoption of green certification of building is the fear of additional construction cost. To overcome this barrier, these authors suggest that financial incentives and innovative fiscal arrangements should be made available so that the extra cost could be accepted with the help of financing arrangements. Incentive is a factor that motivates a person to a particular goal (US Green Building, 2004). Incentives could be in the form of financial incentives or fiscal incentives. Financial incentives are direct monetary funds, grants, loans, rebates, etc. provided by government as a financial support for developers who propose or are willing to involve in green developments (Hashim *et al*., 2016). Reduced taxes as a green building incentive gives a wide appeal in the private and public sectors and further encourages the adoption of green building certification (US Green Building, 2004).

"Tax rebates for contactors who construct green building projects should be instituted so as to encourage contractors to always bid for green building projects.

Reduction of import duties on green building materials should also be encouraged" (Professional Body 2)

"Special Mortgage incentives for green building incentives, tax reduction on green building materials, reduction of import duties on green building materials, public acknowledgement of people who go into green certification of buildings" (Professional Body 3)

Also there could be fiscal incentives where unlike the financial incentives, it is a privilege from the government in terms of tax exclusion from paying any tax. Some of the incentives that emerged from the interviews conducted were:

- *Tax incentives for contractors*
- *Loans/Grants for green building projects*
- *Reduced taxes on green building materials*
- *Duty free on solar panels and other energy efficiency equipment and green materials*
- *Free Training Materials*
- *public acknowledgement of people who go into green certification of buildings*
- *Special Mortgage incentives for green building*

e) Public acknowledgement

Respondents also highlighted that owners of green certified buildings need to be acknowledged publicly as a means of motivating others to also adopt green certification systems.

public recognition of those who adopt the green certification of buildings so that their buildings become an advocacy point for the masses of people (Professional Body 3)

f) Policies and Regulations

Interviewees made a clear indication that lack of policies is the major reason why people have not adopted the green certification of buildings. Over the years developed countries have moved from "testing the waters" with green building pilot projects to developing wide-reaching policies that incorporate green building certification (Annie *et al*., 2007).

"Bye-Laws should be updated to incorporate green certification of buildings. Building inspectors should be trained and equipped to efficiently inspect buildings in the course of construction" (Professional Body 1, Professional Body 6, Professional Body 7)

"Policy on applying the green certification on at least 70% of their public projects, there should be a collaboration between academia, research and government" (Professional Body 5)

"The government should introduce a policy where all public projects will attain a green certification" (Professional Body 2, Professional Body 4, Professional body 5, Professional Body 6, Professional Body 9)

"Involvement of government by legislation. An example is if your building is over a certain limit of square meters and you do not get your design certified, you will not get a permit. Legislation like every government building must be certified. That is a key way of getting rapid compliance from masses of people" (Professional Body 9)

g) Effective Communication and Source of Information

Communication is the process by which participants create and share information with one another in order to reach a mutual understanding. Diffusion is a particular type of communication in which the information that is exchanged is concerned with new ideas (Rogers, 2003). Some of the interviewees pinpointed that issue on green building are communicated to them on a monthly basis. They also indicated that, that medium of communication makes them trust the information.

"Our monthly issue of magazines, give us links to sites or organisations that talk about green certification of buildings. Our professional body connects us to official documents on green certification of buildings from different governments. An example is Building Research Establishment whose link was in one of our journals so then, if you are interested, you can click and read more about them (Professional Body 1)*."*

Another interviewee also pinpointed the Ghana Green Building Council as a source of information concerning green certification of buildings.

"The Ghana Green Building Council is the right source of information" (Professional Body 2, Professional Body 3, Professional 5, Professional 9, Professional 10)

Some of the interviewees also identified FM stations and TV stations as means of reaching a larger audience and educating them on green certification of buildings. Interviewees 1 and 3 provided the following comments during the interview:

"FM Stations, TV stations. Mass media are effective ways of communicating green certification of buildings. The media can be invited during seminars or workshops to publicly communicate it to the general public. Research findings should be made known to the media as well." (Professional Bodies' response).

"Because of language barrier, the communication must be localised to be able to be understood by all kinds of people. The approach to education should be grouped into technical people, prospective homeowners, financiers" (Professional Body 3).

4.4.5 Theme 6: Evaluation

4.4.5.1 Setting up an evaluation body

Interviewees were asked to identify the body that would conduct the evaluation of a project to assess its conformity with the requirements of green certification of building especially if it will be legalised in the future.

Government Agencies can be charged to aid in the evaluation process (Professional Body 1)

"A neutral evaluation body should be set up to effectively evaluate buildings according to the green certification systems" (Professional Body 3)

Decentralisation by leaving the basic ones to the developers, People should also be trained in the evaluation (Professional Body 6)

"Monitoring and evaluation is important. They should be done by the GhGBC" (Professional Body 8)

For green certification of building to be implemented, its requirements must also be clearly defined and distributed to all professional bodies

"Areas to be evaluated should be clearly defined and communicated to each professional body" (Professional Body 2)

The evaluation body must be trained and equipped to handle their responsibilities

"People should be trained and well equipped to be able to properly evaluate"

(Professional Body 7)

4.5 PROPOSED FRAMEWORK FOR THE IMPLEMENTATION OF GREEN CERTIFICATION OF BUILDINGS

This research has aggregated and augmented the responses from the interviews and put forth these guidelines for the implementation of green certification of buildings. The guidelines as presented below have been formulated from the proposed framework as shown in Figure 4.1. The proposed framework has six (6) inter-connected steps which was further divided into three inter-connected phases.

4.5.1 Knowledge Acquisition Phase

a) Exposure

Professional bodies should be involved in the adoption of green certification of buildings. These professional bodies should liaise with the Ghana Green Building Council to train them in green certification of buildings and its requirements. Some of the ways that the professional bodies can get involved is by identifying their roles in this green building certification and incorporating it into their code of ethics. Therefore, if they are incorporated in the code of ethics of professional bodies it becomes a requirement that members would now actively seek for information on how to apply this on their building projects. Another means of exposure is through incorporating it into the educational curriculum. Some of these professional bodies have made alliance with other institutions to train their members on this green certification of buildings. However, most of them acknowledged that, the Ghana Green Building Council should spearhead this training exercise and make available to them the necessary training materials to aid this.

b) Knowledge

The second stage of the conceptual framework answers questions like "Where can information be found?", "What is the green building certification system?", "How does it work?" There is the need for more awareness on what this green building certification is, how it can be used and where to get reliable information. Interviewees mentioned that members of their professional bodies need to be educated more. These professional bodies should be trained to effectively adopt this green certification of buildings when the need arises. Green building projects must be issued on websites and in brochures to sell green building achievements. The maintenance of a green building database which is easily accessible and linked to websites of various professional bodies is key in order to provide a consistent and accurate information. The system will ensure the easy availability of information and accurately shared among stakeholders and these professional bodies to promote enhanced discussions among themselves. Data from past projects should be stored on these dedicated websites and retrieved when necessary to support decision making when adopting the green certification of buildings. This database should include the details of energy consumption and environmental loading data of construction materials and products.

c) Persuasion

Observability of the benefits of having a building certified according to the green building standards persuades people to adopt it. The Ghanaian society can better appreciate green building certification if the benefits of using the certification system on the few green buildings are visible for the would-be adopters to know how feasible that is. As Darko and Chan (2016) agrees that there is non- awareness of clients and customers on the potential benefits of green building certification system, it will be difficult for such individuals to show interest and consequently place demands on such

certified buildings. The interviewees confirmed that by stating that the benefits of the green certified buildings in Ghana have not been effectively communicated to the masses of people. Data on initial cost of constructing these green buildings must be compared to the life-cycle cost and documented for the purposes of educating others.

The documentation of performance, costs and benefits of green buildings must be practiced, to expand the market. These benefits are mostly not tangible. These benefits are often realised over a longer period with healthier occupants with a positive environmental and social impact on the community as well as lower operating costs. The benefits of green certified buildings must be quantified including the information connected to its detailed features and information related to other indirect benefits such as health to enhance the adoption of green certification of buildings.

Also, according to Landman (1999), the responsibility for learning, educating, demanding and implementing more sustainable or green practices depends on the government rather than the private sector. The interviewees mentioned that they have not seen any visible commitment from the government especially in certifying their public buildings. They also added that they would have made efforts at promoting it if the government had shown some commitment. It should be noted that the government's involvement gives legitimacy to the efforts of environmental advocacy groups like the Ghana Green Building Council. The legalisation of green certification of buildings will persuade people to adopt it. An interviewee mentioned that government has shown interest in this green certification of buildings by modifying the Ghana Building Code which will include some elements of green certification of buildings.

The mass media is also an effective way of sensitizing masses of people to adopt this green certification of buildings. The Ghana Green Building Council should use mass media to effectively propagate the green certification of buildings. The government must also support the activities of the Ghana Green Building Council by funding their activities especially their media outreaches.

4.5.2 Implementation Phase

d) Decision

Incentives are crucial in supporting the adoption of green certification of buildings. Higher up-front costs, potential risks and lack of the know-how and training are often cited as reasons why green certification systems are not adopted. To overcome this, government can provide incentives as a way to stimulate the adoption of green certification of buildings. The use of incentives can be applied to stimulate interest, bridge gaps and encourage green building practices. By providing property tax exemptions and sales tax exemptions, the government either wholly or partially offsets the cost of purchasing, manufacturing, installing and building new green technologies. Non-monetary incentives like loans, expedited permit, assisting research and development, technical assistance, marketing assistance and dedicated staff for green development in building and planning departments can also expedite the adoption of green certification of buildings. In the quest to bridge the difference between the cost of conventional buildings and certified green building projects, having low interest loans, grants or other financial tools can be useful.

d) Implementation

Implementation is when an innovation is put to use. There is a difference between the decision to adopt green building certification tool and the decision to put it in to use. The availability of professionals who specialise in green building certification is key to push forward with the application of green assessment system. People would have to be trained on how to use this green building certification system before they can apply them on their projects. One of the barriers identified in literature and during the interviews was lack of information on this green building certification system. The professional bodies who had trained their members on this Edge certification which is a green building certification system admitted that there is the need for more training, how much more those who have never trained their members on them.

4.5.3 Evaluation Phase

e) Evaluation

This is the final stage in the framework where according to Rogers (2003) the organisation would assess the benefits and consequences of this innovation. However, in the context of green certification of buildings the evaluation is recognised as identifying the requirements that need to be fulfilled before the project is evaluated and passed as a green building project. The institution or body who is responsible for this evaluation, train people to effectively discharge their duties in project evaluation.

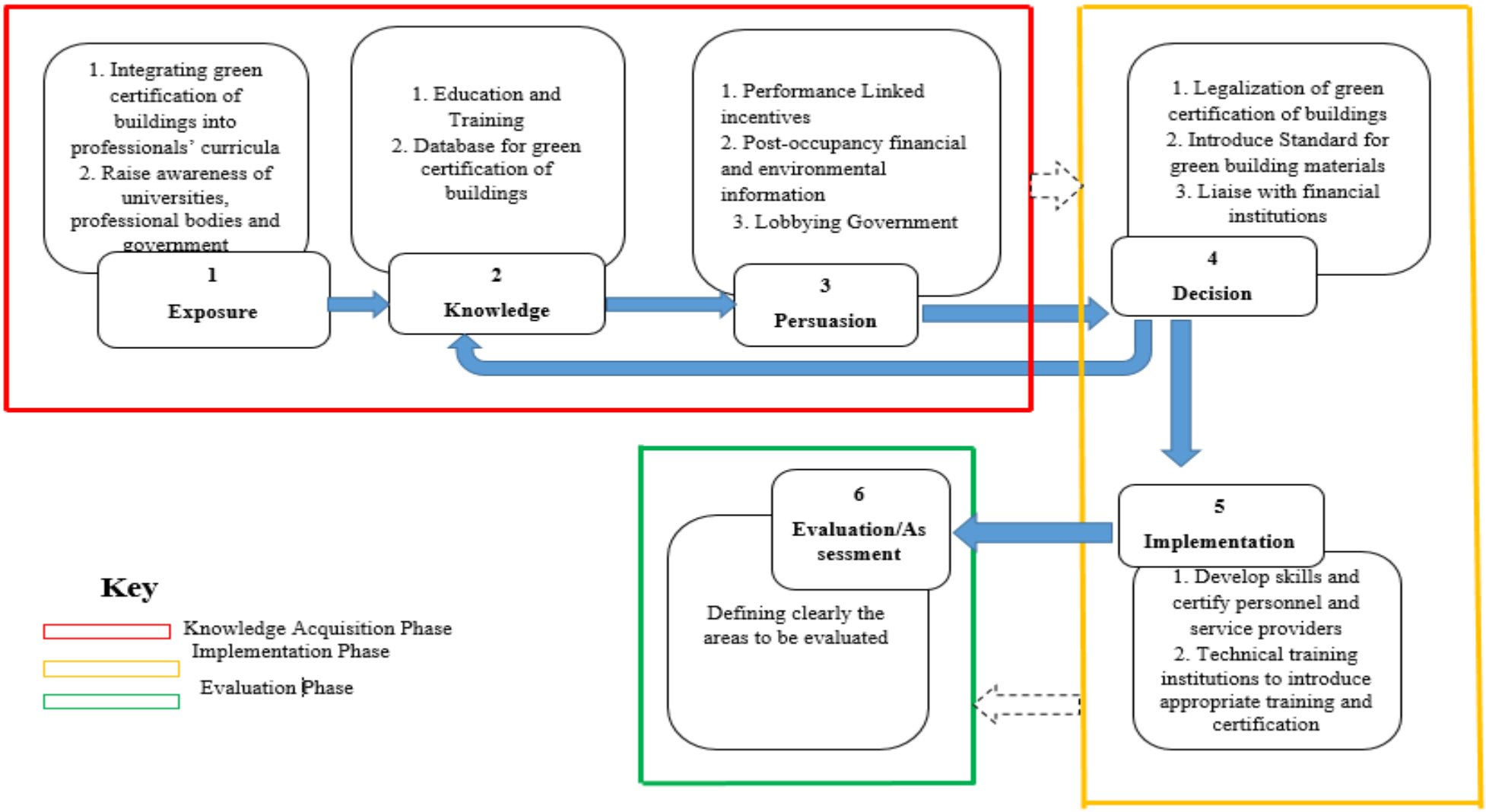

Figure 4.1 Proposed Framework for The Implementation of Green Certification of Buildings

Tables 4.1 to 4.3 summarizes a list of action points which are practical steps that can aid the certifying body in making decisions in relation to implementing the green certification of buildings.

Table 4.1 Action Points in the proposed framework for the implementation of green certification of building

Theme	Action	Rationale	How to Deliver
Exposure **Exposure**	Integrating green certification of buildings into professionals' curricula	This is due to lack of skilled professionals for green building design and construction The professional bodies are the mainstream to incorporate green practices	Develop appropriate curricula
	Raise awareness of universities, professional bodies and government		TV, Radio, Ghana Green Building Council should provide reliable sources of information Raising awareness through knowledge development, dissemination of research and capacity building outreach.

Table 4.2 Action Points in the proposed framework for the implementation of green certification of building cont'd

Theme	Action	Rationale	How to Deliver
Knowledge	Education and training	The need to know how green certification can be used on projects	1. Education and training must be intensified to improve the knowledge of both the private and public sector on green certification of building. 2. Conducting research and trainings, funding educational campaigns
	Database for green certification of buildings		1.In order to provide a consistent and accurate information, certifying body must maintain a green database which can be linked to the websites of the various professional bodies
Persuasion	Document information on green buildings	To document the benefits and to be used in creating awareness	1. Gathering and analyzing of post-occupancy financial and observed benefits information that will improve the knowledge of green building features and financing
	Lobbying Government	Raise awareness of government	1. Lead by example like certification of public buildings: community schools, district assembly halls etc.

Table 4.3 Action Points in the proposed framework for the implementation of green certification of building cont'd

Theme	Action	Rationale	How to Deliver
Decision	Incorporate green certification of buildings in byelaws on buildings	The voluntary green certification of buildings limits its uptake	1. Byelaws must be used as models on green building 2. Governments should enhance the authority of municipal authorities to adopt and implement coherent and comprehensive policies and codes to require green building in the private sector
	Introduce standards for green building materials	To develop a market for green materials where materials for green building becomes easily accessible	1. Building materials and products must be tested and certified 2. Provision of tax and other financial incentives for green building on the basis of performance
	Liaise with financial institution	Need to increase capital available for green building	1. Raise awareness of financial institutions 2. Special Mortgage incentives for green building
			1. Tax rebates for contractors 2. Reduced taxes on imported green building materials

Table 4.4 Action Points in the proposed framework for the implementation of green certification of building cont'd

Theme	Action	Rationale	How to Deliver
	Performance linked incentives for compliance with green certification of buildings	This is to ensure that certified buildings remain green throughout their lifecycles	Provision of tax and other financial incentives for green building on the basis of performance
Implementation	Develop skills and certify personnel and service providers	Lack of skilled personnel and the need to have easily accessible appropriate skilled personnel	1. Technical training institutions to introduce appropriate training and certification 2. Awareness of benefits to raise demand from educational institutions
Evaluation	Documentation and distribution of the requirements of green certification of buildings	Lack of awareness of the requirements and processes of green certification of buildings	1. Areas to be evaluated in green certification of buildings should be clearly defined, documented and made available to all

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

The aim of this study was to propose a framework for the implementation of green certification of buildings in Ghana. This framework has guidelines which are practical steps that can aid the certifying body in making decisions in relation to implementing the green certification of buildings. In order to accomplish the aim of the study, four objectives were set. This chapter presents conclusion and recommendations on the results from the study. The contributions that this study makes to theory and practice together with identified limitations of the study have been highlighted.

5.2 RESEARCH QUESTIONS

From the beginning, four research questions were set:

1. What is the level of knowledge of built environment professionals on green certification of buildings in Ghana?
2. What are the drivers for green certification of buildings in Ghana?
3. What are the barriers to green certification of buildings in Ghana?
4. How can green certification of buildings be implemented in Ghana?

5.3 ATTAINMENT OF RESEARCH OBJECTIVES

The aim of the study was to propose a framework for the implementation of green certification of buildings in Ghana. The findings for each objective in the research has been summarized as follows:

5.3.1 Objective One: To determine the level of knowledge of built environment professionals on green certification of buildings in Ghana.

Some of the professional bodies interviewed demonstrated the effort they are currently making in promoting the green certification of buildings amongst their members. Some had already had training sessions and meetings with some organizations concerning green certification of buildings. On the other hand, there were some bodies that had never used any platform to educate their members on the green certification of buildings at all. This notwithstanding, one striking observation made during the interview was that some of these professional bodies who were advocating for green buildings were doing so without discussing about green building certification systems. In as much as efforts are being made by these professional bodies to promote green buildings, there is the need to relate it to a green certification system. Many studies have indicated that a building can be classified as "green" after it has been evaluated using a rating or certification system which can either be LEED, BREEAM, Green Star, HK-BEAM etc.

5.3.2 Objective Two: To determine the drivers for green certification of buildings in Ghana.

The professional bodies interviewed acknowledged that there were some drivers that could speed up the adoption of green building certification. These professional bodies indicated that the benefits of a certified green building should be made known publicly so as to motivate individuals to follow suit. They also indicated that Commitment of Government, incorporating it into the code of practice of professional bodies, Green Building Certification Incentives, Public acknowledgement, Policies and Regulations can push individuals to adopt the green certification of buildings.

5.3.3 Objective Three: To determine the barriers to green certification of buildings in Ghana.

Lack of legal backing, Social Acceptance of new technology/ Conservative nature of Ghanaians, Cost and financing were confirmed as the barriers that make it almost impossible for people to adopt green certification of buildings. Furthermore, inadequate realization of the advantages and benefits of green certification of buildings, inadequate human resource, and lack of knowledge were confirmed as the barriers of green certification of buildings. Lack of government support, lack of observability of benefits among others were also identified as barriers to green certification of buildings.

5.3.4 Objective Four: To propose a framework for the implementation of green building certifications

A framework was proposed which has guidelines to aid the certifying body in implementing green certification of buildings in Ghana. These guidelines were based on the findings from the interviews conducted. Roger's innovation diffusion theory was used to propose a framework for the implementation of green certification of building. The guidelines should aid the certifying body in taking actionable steps for green certification of buildings to be heavily diffused in the Ghanaian construction industry.

5.4 CONCLUSION

In conclusion the study identified that the level of knowledge of built environment professionals were low since only 3 of the professional bodies had trained the members in green certification of building. Furthermore, observability of the benefits of the green certified buildings, Commitment of Government, Incorporating it into the

code of practice of professional bodies, Green Building Certification Incentives, Public acknowledgement, Policies and Regulations, Effective Communication and Source of Information as the major drivers to the green certification of building in Ghana. Also,

Lack of legal Backing, Cost and Financing, Inadequate awareness of the benefits of green certification of building, Inadequate human resource, Lack of active government participation, Conservative Nature of Ghanaians were identified as the major barriers to green certification of buildings. However, it is worth knowing that adequate training and sensitising of the public can help create the awareness of green certification of buildings and providing the necessary incentives to help people to adopt it. Also, recognizing that the GhGBC and professional bodies plays a pivotal role in the implementation of green certification of buildings not forgetting the government is necessary in the adoption and diffusion of green certification of building in Ghana.

5.5 RECOMMENDATIONS

Based on the findings from this study, the following recommendations have been made:

- There is the need to create a firm backing for an integrated design tactic to green buildings due to the requirement that, the involvement of all stakeholders including the Architects, Engineers, Consulting teams, Planners and users in the early phase of the project are crucial, to address project goals, needs and potential barriers. This can be used to avoid “over design” which is an additional cost for features that are unnecessary or are already taken care of by natural environmental factors or parts of other systems in the building.

- Professional Bodies must identify their roles in the green certification of buildings and train their members on such specific roles.
- Research conducted on green certification of buildings must be disseminated to the right government institution and the Ghana Green Building Council.
- Awareness and knowledge must be raised through research and development capacity building outreach.
- The establishment of protocols for monitoring and testing must be used to enable the effective tracking of progress on achieving these targets for green buildings and accumulate information to continually support the improvement in implementation and the development of policies.

5.6 RESEARCH CONTRIBUTION

5.6.1 Theory

Though the use of Roger's innovation diffusion theory has been adapted by different sectors it was limited in using it to develop guidelines that will aid decision-makers in implementing innovations such as green certification of buildings. This study has demonstrated its ability to suit the aim of this research.

5.6.2 Practice

The aim of this study was to propose a framework for the implementation of green certification of buildings in Ghana to be used by the certifying body in implementing this green certification of buildings. The framework has guidelines which are practical steps that can aid the certifying body in the implementation of green certification of buildings.

5.7 LIMITATIONS OF THE STUDY

Despite the numerous contributions made by this study, it will be highly un-academic to say that it was without any limitations. Key among the limitations identified are the following:

1. Taking into account the size of the interviewees, it is difficult to draw generalizations from the output of this study. However, this empirical research adopted a structure to provide insight into how the professional bodies in the built environment use their influence in promoting green certification of building and how the green certification of buildings can be properly diffused into our construction industry. The outcome of this research can help the certifying body in implementing green certification of buildings. 2
2. The proposed framework has not been validated because it was predicted that the availability of the respondents for validating the framework would be a challenge just as it was a challenge during the data collection.

5.8 FUTURE RESEARCH

1. Similar research should be conducted to quantitatively identify the drivers and challenges in adopting the green certification of buildings from stakeholders in the construction industry.

2. There should be a case study on the Ghana Green Building Council in order to uncover challenges that they face and propose solutions so as to make them better equipped to be able to discharge their duties effectively.

3. Similar studies can be conducted on green buildings in Ghana to uncover design and construction challenges in order to learn from them.

4. The proposed framework should be validated to ensure that its implementation can be without challenges.

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APPENDICES

Appendix I – Semi-Structured interview guide

6th November, 2017

The Secretariat

Ghana Institute of Construction

Kumasi

Dear Sir/Madam,

LETTER OF INTRODUCTION

I write to confirm that **Miss Godslove Ampratwum** is an MPhil Construction Management student in the Department of Building Technology, College of Art and Built Environment, KNUST, Kumasi.

She is undertaking a research work titled **"Developing A Framework for Green Certification of Buildings in Ghana."** As part of her research, she is required to collect data through interview. The Ghana Institute of Construction has been identified as part of the key stakeholders in green building.

I would be grateful if your outfit can partake in this research by nominating one person with knowledge on the subject matter to represent the Institute during the interview.

I wish to express my sincerest appreciation to you in advance in anticipation of your co-operation.

Yours Faithfully,

Dr. Theophilus Adjei-Kumi

Head of Department

To whom it may concern

Dear Sir/Madam,

Invitation to participate in a research in developing a framework for green certification of buildings in Ghana

I write to request your assistance as an experienced practitioner with substantial knowledge in the green certification of buildings. I am undertaking an MPhil in Construction Management in the Department of Building Technology of Kwame Nkrumah University of Science and Technology under the supervision of Dr. Kofi Agyekum. This research is entitled "**Developing a framework for green certification of buildings in Ghana."**

This research aims to develop a conceptual framework to enhance the implementation of green certification of buildings in Ghana. Also this research will further identify the drivers and barriers to the green certification of buildings. Hence, by partaking in this interview your expert knowledge will be extremely useful in this research in developing this framework which will help in the implementation of green certification of buildings.

Please find attached a copy of the interview guide which would be used during the interview. I would be grateful if you give a copy of the interview guide to the representative of the Institute to read ahead of time in order to familiarise with the questions and prepare towards it. The interview will last for 45 minutes. The representative is to give the date, time and venue for the interview within the stipulated period. Miss Godslove Ampratwum can be contacted through her email: godslovetwum@gmail.com or phone number: 0246292406.

Thank you again for your kind consideration.

Sincerely,

Godslove Ampratwum, MPhil Student

Dr. Kofi Agyekum, Supervisor

Department of Building Technology

The Kwame Nkrumah University of Science and Technology, Ghana

INTERVIEW GUIDE

This semi-structured guide consists of detailed questions that will be discussed during the interview with targeted respondents aimed at developing a framework to enhance the implementation of green certification of buildings in Ghana.

Section A: Background Information

Professional Body/Organisation/Institution……...

Date of the Interview……**.....**

Position in the professional body/organisation/institution……

Email/Contact…….

Years of working experience in your profession……**...**

Section B

Theme 1: Exposure Stage

1. Is your professional body/organisation/institution aware of green certification of buildings? If Yes, then how did you know about it?
2. Do you recognize the importance of green certification of building?
3. How often are members/workers encouraged to adopt the green certification of buildings?

Theme 2: Knowledge Stage

4. Is there a need for members in this professional body/organisation/institution to be educated more on the green certification of buildings?
5. Do members/workers know how the green certification of building works? If yes, explain

6. Apart from getting information from the professional body/organisation/institution, which authentic place do you think they can get information?
7. Are you aware of any green building certification tools?
8. Do you think the process of green certification of buildings is complex? If Yes. Explain

Theme 3: Persuasion Stage

9. How can the mass media and interpersonal communication be effectively utilized in promoting the green certification of buildings? Also among them which is a more powerful and effective in promoting the green certification of buildings?
10. Do people need to see the benefits of green certification of buildings as a means of motivating them to do the same?
11. How would you characterize the Government's interest in green certification of buildings in Ghana?

Theme 4: Decision

12. What do you think are the possible reasons why people will not adopt after they become aware of the possible benefits?

Theme 5: Implementation

13. What structures can be put in place to ensure the successful implementation of the green certification of buildings after decision has been made by people to adopt it.

Theme 6: Evaluation/Assessment

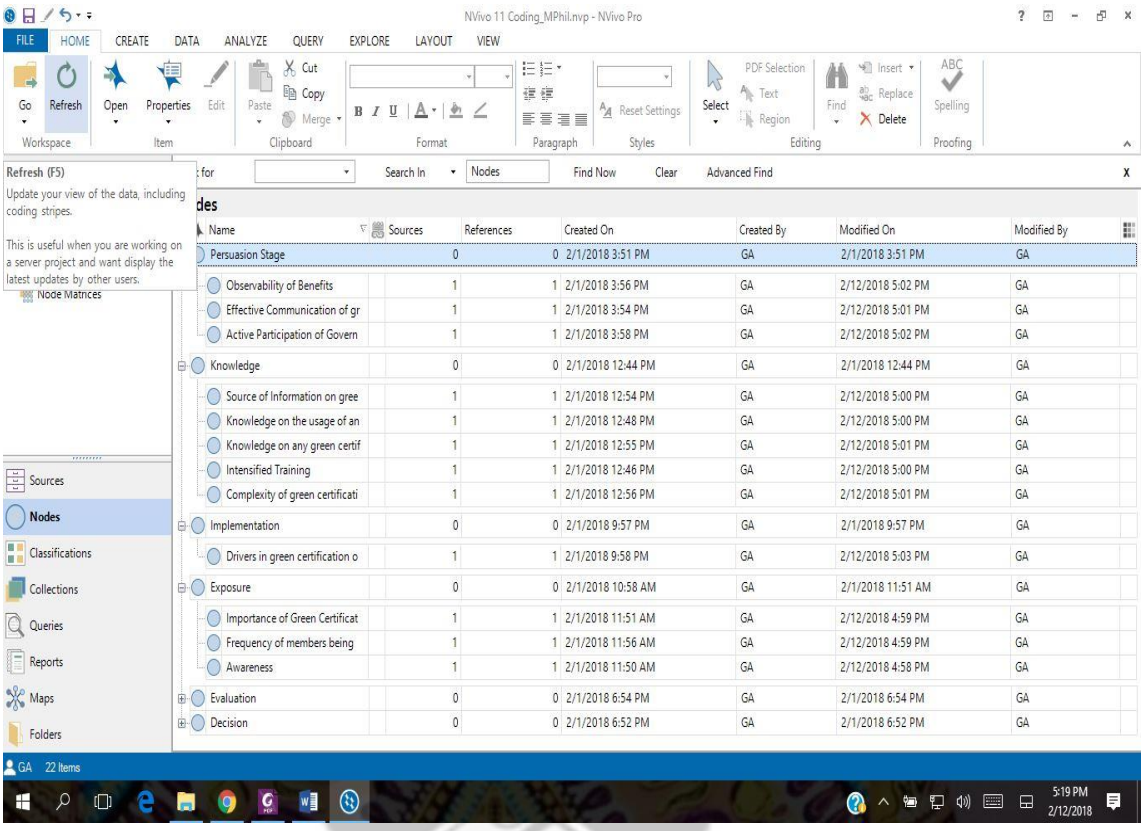
14. How do you think the adoption of green certification of building should be evaluated in order to improve upon it?

Section C

Additional Questions

15. In your opinion, what else can be done to enhance the uptake of green certification of buildings in Ghana?
16. As a professional body/organisation/institution what do you think needs to be done to make green certification of buildings compatible with our construction industry?
17. What role can the government play in the green certification of buildings?
18. How can the other professional bodies in the built environment also help promote the adoption of the green certification of buildings?

Appendix II –Analysis Table and Charts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HOME
CREATE
DATA
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QUERY
EXPLORE
LAYOUT
VIEW
Refresh (F5)
Update your view of the data, including coding stripes.
This is useful when you are working on a server project and want display the latest updates by other users.
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Nodes
Find Now
Clear
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Sources
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Persuasion Stage
Observability of Benefits
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Implementation
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Exposure
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Frequency of members being
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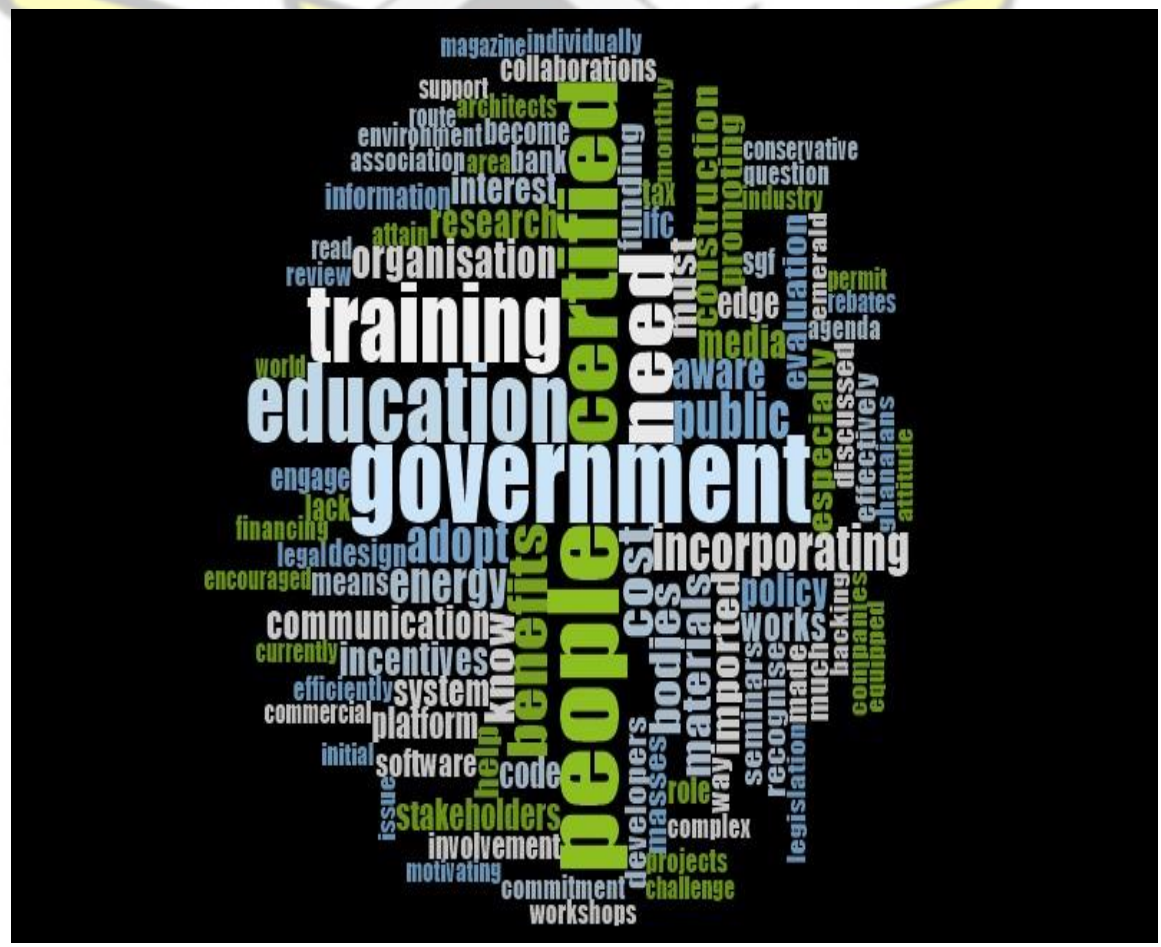
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promoting
conservative
question
industry
sgf
emerald
permit
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lack
financing
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encouraged
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system
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