

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI,  
GHANA**

**The Impact of Project Management on Sustainable Construction in Ghana**

By

**Richard Douglas Kwesi Dadzie (BSc. Construction Technology and Management)**

A Dissertation submitted to the Department of Construction Technology and Management,

College of Art and Built Environment

in partial fulfillment of the requirements for the degree of

**MASTER OF SCIENCE**

**NOVEMBER, 2018**

**DECLARATION**

I hereby declare that this submission is my own work towards the MSc Project 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.

**RICHARD DOUGLAS DADZIE (PG1149117)**

Student's Name & ID

.....

Signature

.....

Date

Certified by:

**PROFESSOR JOSHUA AYARKWA**

Supervisor's Name

.....

Signature

.....

Date

Certified by:

**PROFESSOR BERNARD K. BAIDEN**

Head of Department's Name

.....

Signature

.....

Date

## **ACKNOWLEDGEMENT**

My acknowledgement goes first and foremost to the Almighty God for enabling me with the ability to undertake this course. I am also grateful to my supervisor Professor Joshua Ayarkwa and his assistant Mr. De-Graft Joe Opoku for their direction support in the creation of this study.

My final acknowledgement goes to my family for their tremendous support throughout the course.

## **ABSTRACT**

The construction industry has been evolving considerably over the years with an increase in creative structures which require higher technological methods for their construction. It has also however become necessary to develop sustainable means of constructing these structures to enable them fit into the ecological, social and economic needs of the communities in which the structures are situated which forms the basis of this study to search into the sustainable development concepts adopted by construction companies in the Greater Accra region of Ghana during the first three phases of the project management life-cycle, namely; the Initiating Phase, the Planning Phase and the Execution Phase. The general methodology of this submission is relied largely on survey questionnaire which were received from professionals within the construction industry. A thorough literature review was initially conducted to identify the various concepts of sustainable development. A total of 28 questionnaire was distributed to construction professionals such as Project Managers, Quantity Surveyors, Structural Engineers and Site Supervisors which received a hundred percent response rate. The Statistical Package for Social Sciences (SPSS version 16.0) together with Microsoft Excel was used for the analyzing the data. From the study, it is discovered that although there is a lot of consideration given to sustainable development during the Initiating phase of projects, these considerations tend to reduce as the projects progresses through the Planning and Execution phases. The study recommends that a proper assessment of sustainable development needs be carried out for each project and the need to include all stakeholders during the planning of the projects.

**Keywords:** Sustainable development, Construction, Project Management

## TABLE OF CONTENTS

<b>DECLARATION.....</b>	<b>ii</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>iii</b>
<b>ABSTRACT.....</b>	<b>iv</b>
<b>LIST OF TABLES.....</b>	<b>viii</b>
<b>LIST OF FIGURES.....</b>	<b>ix</b>
<b>CHAPTER ONE.....</b>	<b>1</b>
<b>INTRODUCTION.....</b>	<b>1</b>
1.0 BACKGROUND OF THE STUDY.....	1
1.1 STATEMENT OF PROBLEM.....	2
1.2 RESEARCH QUESTIONS.....	2
1.3 AIM OF THE STUDY.....	3
1.4 OBJECTIVES OF THE STUDY.....	3
1.5 JUSTIFICATION OF THE STUDY.....	3
1.6 METHODOLOGY.....	4
1.7 SCOPE OF THE STUDY.....	4
1.8 ORGANIZATION OF THE RESEARCH.....	4
<b>CHAPTER TWO.....</b>	<b>6</b>
<b>LITERATURE REVIEW.....</b>	<b>6</b>
2.1 INTRODUCTION.....	6
2.2 CONCEPT OF SUSTAINABLE DEVELOPMENT.....	6
2.1.1 Environmental Sustainability.....	8
2.1.2 Economic Sustainability.....	10
2.1.3 Social Sustainability.....	11
2.2 SUSTAINABLE CONSTRUCTION.....	11
2.2.1 Environmental Sustainable Construction.....	15
2.2.2 Economic Sustainable Construction.....	17
2.2.3 Social Sustainable Construction.....	18

2.3 PROJECT MANAGEMENT AND SUSTAINABILITY .....	20
<b>CHAPTER THREE .....</b>	<b>22</b>
<b>RESEARCH METHODOLOGY .....</b>	<b>22</b>
3.1 INTRODUCTION.....	22
3.2 RESEARCH PROCEDURES .....	22
3.3 RESEARCH STRATEGY .....	23
3.4 STUDY POPULATION .....	23
3.5 QUESTIONNAIRE STRUCTURE .....	23
3.6 SAMPLING TECHNIQUE .....	24
3.7 DETERMINATION OF SAMPLE SIZE .....	24
3.8 Data Presentation and Analysis.....	25
<b>CHAPTER FOUR.....</b>	<b>26</b>
<b>RESULTS AND DISCUSSION .....</b>	<b>26</b>
4.1 INTRODUCTION.....	26
4.2 DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS .....	26
4.3 KNOWLEDGE OF SUSTAINABLE CONSTRUCTION, SUSTAINABLE DEVELOPMENT CONCEPTS AND PROJECT MANAGEMENT LIFE-CYCLE .....	28
4.4 SUSTAINABLE DEVELOPMENT CONCEPT ADOPTED THE FIRST THREE PHASES OF THE PROJECT MANAGEMENT LIFE-CYCLE .....	30
4.4.1 INITIATING PHASE.....	30
4.4.2 PLANNING PHASE .....	34
4.4.3 EXECUTING PHASE.....	37
<b>CHAPTER FIVE .....</b>	<b>41</b>
<b>CONCLUSION AND RECOMMENDATIONS .....</b>	<b>41</b>
5.1 INTRODUCTION.....	41
5.2 RESEARCH PROCESSES ADOPTED .....	41
5.3 FINDINGS OF THE STUDY .....	42
5.4 CONCLUSION .....	43

5.5 RECOMMENDATIONS .....	44
5.6 SUGGESTIONS FOR FUTURE STUDY.....	45
<b>REFERENCES.....</b>	<b>46</b>
<b>APPENDIX.....</b>	<b>51</b>

## LIST OF TABLES

Table 1. 1 Applicable Criteria for Mixed-Use Building with GFA less than 2000m <sup>2</sup> (BCA, 2010) .....	17
Table 4.1 Professional Background of Respondents .....	27
Table 4.2 Respondents years of Experience .....	27
Table 4.3 Knowledge of Sustainable Construction.....	28
Table 4.4 Knowledge of Sustainable Development Concept .....	29
Table 4.5 Knowledge of Project Management Processes/ Life-cycle .....	30
Table 4.9 Initiating Phase- Economic Concept.....	31
Table 4.10 Initiating Phase- Environmental Sustainable Concept.....	32
Table 4.11 Initiating Phase- Social Sustainable Concept .....	33
Table 4.12 Planning Phase- Economic Sustainable Concept.....	34
Table 4.13 Planning Phase- Environmental Sustainable Concept .....	35
Table 4.14 Planning Phase- Social Sustainable Concept.....	36
Table 4.15 Executing Phase - Economic Sustainable Concept.....	38
Table 4.16 Executing Phase - Environmental Sustainable Concept .....	39
Table 4.17 Executing Phase - Social Sustainable Concept.....	40

## LIST OF FIGURES

Figure 2.1 Sustainability (1999).....	8
Figure 2.2: Life time of project vs. Life time of construction (Parkin, 2000).....	13
Figure 2.3: Extent of Environmental and Social Considerations in the Life Cycle of Projects (Labuschagne, 2005).....	21
Figure 4.1 Professional Background of Respondents .....	27
Figure 4.2 Respondents years of Experience .....	28
Figure 4.3 Knowledge of Sustainable Construction.....	29
Figure 4.4 Knowledge of Sustainable Development.....	29
Figure 4.5 Knowledge of Project Management Processes/ Life-cycle .....	30
Figure 4.9 Initiating Phase- Economic Sustainable Concept .....	31
Figure 4.10 Initiating Phase- Environmental Sustainable Concept.....	32
Figure 4.11 Initiating Phase- Social Sustainable Concept .....	33
Figure 4.12 Planning Phase- Economic Sustainable Concept.....	35
Figure 4.13 Planning Phase- Environmental Sustainable Concept .....	36
Figure 4.14 Planning Phase- Social Sustainable Concept.....	37
Figure 4.15 Executing Phase - Economic Sustainable Concept.....	38
Figure 4.16 Executing Phase - Environmental Sustainable Concept .....	39
Figure 4.16 Executing Phase - Social Sustainable Concept.....	40

## **CHAPTER ONE**

### **INTRODUCTION**

#### **1.0 BACKGROUND OF THE STUDY**

Sustainability can be defined as the ability to be maintained at a certain level or rate or the art of avoiding the depletion of natural resources in order to sustain an ecological balance. Sustainability is arguably the most important challenge of this generation. By what means could prosperity be achieved without compromising the life of future generations? Organizations are gradually making sustainability a necessity by integrating sustainable ideas of in their marketing, corporate communication, annual reports and in their actions (Silvius and Schipper, 2014). The World Commission on Environment and Development (Brundtland, 1987) defines sustainable development as “The development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainable development recognizes that growth must be both inclusive and environmentally sound to reduce poverty and build shared prosperity for today’s population while continuing to meet the needs of future generations (Brundtland, 1987).

Projects on the other hand are “instruments of change” within societies and organizations which play vital roles in the realization of sustainable practices and project managers can be described as important “change agents” that have strong influences on the sustainability of these societies and organizations (Silvius, Schiper, et al, 2012).

The role of project management and project managers in the sustainable development context is likely to be particularly important as there is a growing trend towards the reorganization of

tasks and activities places project managers in a noticeable economic and societal position (Sabini, 2016).

### **1.1 STATEMENT OF PROBLEM**

The United Nations Development Program (UNDP) in 2018 stated that sustainable development goals work in the spirit of partnership and practicality to make the right choices now to improve life in a sustainable way for future generations. The term sustainable construction as stated by Atombo et al, (2015) is the construction of environmentally sound structures by the incorporation of recyclable features and the efficient use of resources throughout the life-cycle of the building project. According to Malik (2002), sustainable development could be described as a subset of sustainable development given that sustainable construction dependent on the creation of a healthy built environment based on ecological principles and resource efficiency. Atombo et al, (2015) stated, to obtain solutions to the present construction and infrastructure problems, it will be a necessity to consider the economic, environmental and social aspects of sustainable construction with their interrelations and inevitable balances in the decision making of construction projects. The connection between project management and sustainability concepts create the need to manage the complexity and dynamics of projects, continuously adjust the boundaries of projects, and contribute to the optimization of the business case of the investment initialized by the project (Scott, 2008).

### **1.2 RESEARCH QUESTIONS**

The following questions will be answered in order to properly understand the role of sustainable development within the Ghanaian construction industry and the impact professional project management practices has on these projects;

1. What are the sustainable development concepts considered during the first three phases of the Project Management life-cycle?
2. What factors affect sustainable development decisions in the construction industry?
3. How can project management decisions influence sustainable development goals?

### **1.3 AIM OF THE STUDY**

The aim of this research is to assess the impact of sustainable development and its consideration during the first three phases of the Project Management life-cycle within the Ghanaian construction industry.

### **1.4 OBJECTIVES OF THE STUDY**

The overall objective of this project is to;

1. To identify the sustainable development concepts considered during the first three phases of the project management life-cycle in the Ghanaian construction industry.
2. To identify the factors that influences sustainable development in decision making.
3. To identify how project management decisions can influence sustainable development goals.

### **1.5 JUSTIFICATION OF THE STUDY**

The issue of sustainable development has gradually grown over the years with its focus being to create economically sound projects to reduce the poverty rate globally by creating wealth for the present generation which shall continue to meet the needs tomorrow's generation. But through a variety of market, policy, and institutional failures, earth's natural capital has been used in ways that are economically inefficient and wasteful, without sufficient reckoning of the true costs of resource depletion.

This research seeks to study the reason for failure in completing possible sustainable projects in Ghana, the need of implementing sustainable development goals to all possible projects in

the country and how best professional project management practices can aid in the development goals of Ghana.

## **1.6 METHODOLOGY**

This paper shall be centered on the analysis of past literature and standards established due to the emerging field of the relationship between project management and sustainable development in the construction industry. A series of questionnaire will also generated to attain the input of Ghanaian professionals in respect of the subject matter for qualitative analysis.

## **1.7 SCOPE OF THE STUDY**

This shall be centered majorly on the three areas of sustainability, namely; Environmental, Economic and Social sustainability and how project management practices aid in bringing these goals to reality through the initiating phase till its closing phase of construction projects.

## **1.8 ORGANIZATION OF THE RESEARCH**

The research report shall consist of five chapters. The first chapter will consist of the background of the study, statement of the problem, aims and objectives of the study in relation to the research questions, justification and the scope of the study.

Chapter two shall focus on the review of previous literature on the subject matter. Detailed literature of other writers and researchers from journals and technical documents will be reviewed and also empirical and theoretical literature relevant to the problem being investigated. The third and fourth chapters shall respectively provide a detailed description of the data collection methods used for the study and how the data collected will be analyzed to provide answers to the research questions and objectives.

Chapter five, which is the final part will provide a summary of the findings made during the study, the conclusion of the report and possible recommendations if any.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

This chapter provides a review of literature by various researchers in relation to the definition of sustainability and sustainable development, the ideology of sustainable construction and its relation to project management.

#### **2.2 CONCEPT OF SUSTAINABLE DEVELOPMENT**

Sustainability is one of the worlds most talked about but least understood words. The sustainability concepts were initially described by the World Commission on Environment and Development in the Brundtland report (1987) which defines sustainable development as “The development that meets the needs of the present without compromising the ability if future generations to meet their own needs”. A blog known as the [Environmentalscience.org](http://Environmentalscience.org) describes sustainability as the study of how natural systems function, remain diverse and produce everything it needs for the ecology to remain in balance. Olsen (n.a) characterizes the concepts of sustainability in two form, namely, Weak sustainability and Strong sustainability. Olsen (n.a) describes the “Weak sustainability” as compensating the depletion of resources, breaking down of the ecosystems and species extinction by processes that supports opportunities for continued maintenance or expansion of economic opportunities. This describes nature as a form of capital which can be exchanged with other kinds of capital making sustainable developments as long as it does not cause harm to the views continued fulfillment of economic necessity.

He further describes “Strong sustainability” as that which places emphasis on development which does not lead to irretrievable loss of resources where raw materials, the ecosystems

and all species of animal and plant have value in themselves instead of just being an input in the economic processes.

Yilmaz (2015) also states that sustainability generally means the use of natural resources in such a balanced form that they never decay, get finished or become unrenowable that they could be developed and handed down to the next generations. A lot of attention over the years have been given to the environmental and social aspects of organizational and business activities which are constantly linked to their economic impact in the concept of sustainability (Elkington, 1997). This pushes the directors of the firms to focus their attention on the triple bottom line of sustainability, thus, the People (Social sustainability), the Planet (Environmental sustainability) and Profit (Economic sustainability) with them becoming increasingly accountable to stakeholders (Baskin, 2006).

It has been established that a balanced and consistent corporation of social, environmental and economic constituents of sustainability can provide strategic development ideas to societies and organizations. As there cannot be the absence of economic sustainability where there is social and ecological sustainability, it is acknowledged that social sustainability is a prerequisite of economic sustainability. It must be understood that these three components of sustainability must be considered inseparable because of their full incorporations with one another (HKU Architecture, 2002). Figure 2.1 below shows the interrelation between the Environmental, Social and Economic concepts of sustainable development.



**Figure 2.1 Sustainability (1999)**

### **2.1.1 Environmental Sustainability**

The most regarded areas of sustainable concepts is referred to the relationship between men and nature. Although the different areas of sustainability has never been abandoned, sustainability has majorly been classified as an environmental issue for over thirty years (Drexhage and Murphy, 2010). The issue of environmental sustainability is gradually becoming important as cases of extreme weather conditions, environmental degradation and global warming are experienced. As the population of the world grows, there becomes an increasing need for resources and this brings about the growth of industries to meet the resource needs of the world (Attah, 2010).

Sev (2009) said that environmental sustainability could be defined as “handing over the world to generations yet unborn better than it was taken by protecting the natural arrangements from obliteration. Daly and Cobb (1989) categorize the definition of environmental sustainability in two sections, namely, the Output and Input Rules. The Output rule states that ‘waste emissions from a project or action being considered should be kept within the assimilative capacity of the local environment, without unacceptable degradation of its future waste absorptive capacity or other important services’. The Input rule however

has been further divided to the Renewable and Non-renewable resources with a description on how they should be managed.

- **The Renewable Resources**

This states is the harvest rates of renewable resources must be kept within the recreative abilities of the natural system that produces them. Example is the forest (trees) and animals.

- **The Non-Renewable Resources**

According to the Serafian quansi-sustainable rule, the rate of reduction of non-renewable resource inputs must be targeted below the rate at which substitutes for renewable resources are developed through investments and inventions. Proceeds from liquidated non-renewable resources can be calculated and apportioned to the achievement of sustainable substitutes (Goodland R, 2002).

It is important to always take the ecological balance and the reduction of consuming unrenewable resources into consideration. Resource sustainability is dependent on the resources ability to renew itself (Yilmaz and Bakis, 2015).

Houkara (2007) mentioned that environmental sustainability involves being thoughtful to the issues of;

- Reducing destruction to the environment and living things,
- The sustainable use of renewable resources,
- Protecting the aliveness and diversity on earth
- Protecting cultural and historical environments
- Reducing the usage of unrenewable resources and
- Conserving life-support systems.

A body of the United Nations known as the United Nations Framework Convention on Climate Change (UNFCCC) classified countries into developing and developed sectors based

on the decline of carbon emission in those countries. This is to provide different treatments to the environmental restrictions on greenhouse gasses based on the class of the countries (Attah, 2010). Binding targets had to be set for the European Community and technologically advanced countries by the Kyoto Protocol for the reduction of Greenhouse Gas (GHS) emissions.

### **2.1.2 Economic Sustainability**

Contemporary economic models have anticipated economic activities will increase in the market through the growth in the purchasing power of individuals and by that contributing to an increase in the Gross National Product (GNP) to individuals. From this explanation, it can be understood that development models have an unlimited dependent on production and consumption (Yilmaz and Bakis, 2015). As argued by Gray (2010), “Capitalism and its destructive tendencies are manifest through its greatest creation—the corporation”. Given the depletion of natural resources that is caused through their activities, corporations are required to move towards a state in which they “use only resources that are consumed at a rate below the natural reproduction, or at a rate below the development of substitutes. They do not cause emissions that accumulate in the environment at a rate beyond the capacity of the natural system to absorb and assimilate these emissions. Finally they do not engage in activity that degrades eco-system services” (Dyllick and Hockerts, 2002).

Economic sustainability is also a very important aspect of sustainable development because the balance between production and consumption which must be set by taking into consideration the vulnerabilities of social and ecological issues (HKU Architecture, 2002). It is also mentioned that a sustainable economic development entails;

- The need to have a reduction in prices while providing efficiency through the reduction of energy and resource input needed for manufacturing.

- Adding value to production materials and
- Creating new markets and marketing prospects

### **2.1.3 Social Sustainability**

The final concept of sustainability has to do with freedom and basic rights of human beings with the most projected one as stated by Yilmaz and Bakis (2015) being the balance and equality among generations. They stated that resources can be handed down from one generation to the next to provide wealth and sustain their existence thanks to social sustainability by;

- Increasing the quality of life
- Providing basic requirements such as good health conditions, work, education, a home and cultural activities for each individual.
- Protecting the right to life of the future generations and

## **2.2 SUSTAINABLE CONSTRUCTION**

According to Gunatilake (2013), terms such as high performance buildings, green buildings and/ sustainable buildings have been frequently substituted with Sustainable Construction. The term ‘Green building’ which refer to the entire processes of construction (from the design, construction and operation of constructed facilities) while preserving the natural environment around it and protecting it for future generations has existed much longer than ‘Sustainable buildings’ or ‘Sustainable construction’ and has been used favorably by authors such as Kibert (2008), Dammann and Elle (2006) and Rohracher (2001) (Circo, 2008 and Gunatilake, 2013).

Irurah (2001 cited in Gunatilake, 2013) interprets construction in four ways. These are;

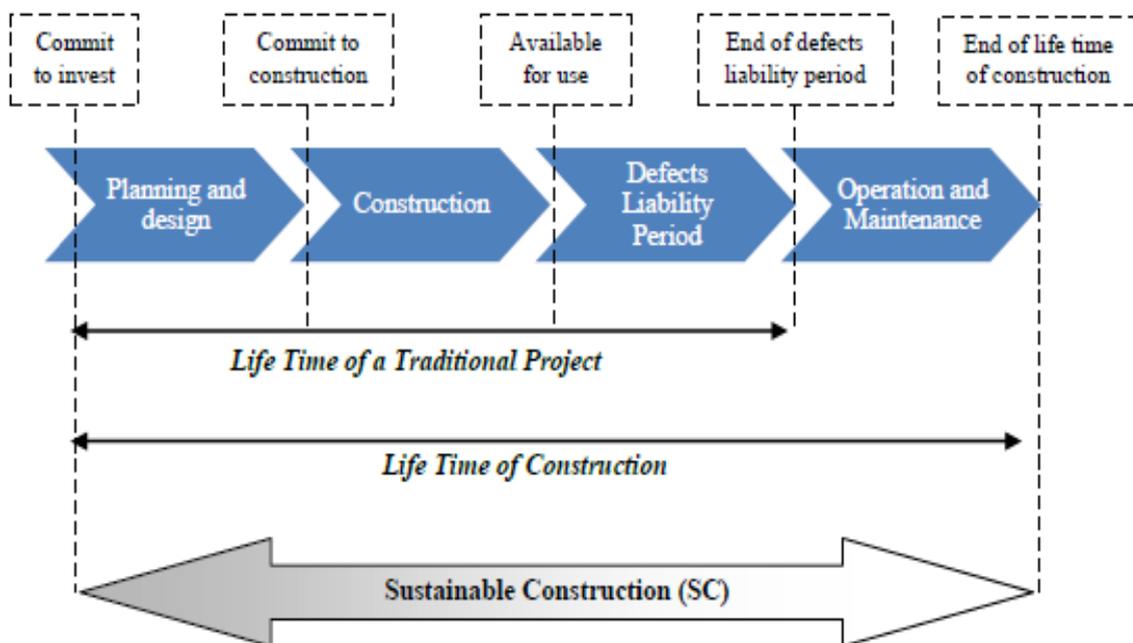
- A broader process of human settlement creation,
- A comprehensive project cycle,

- A site level activity and,
- Everything relating to the business of construction

The doctrines of sustainable development are applied to a wide-range of construction activities ranging from the extraction of raw materials through the planning, designing and construction of the infrastructure till the management of the building's waste as a result of its deconstruction. The process is a very holistic one according to Du Plessis (2002) which aims to reestablish and maintain a peaceful balance between the built environment and its natural habitat in the creation of settlements that uphold the dignity of humans and inspire economic parity. Sustainable development within the construction industry has likewise been defined in many ways. One of such ways is described by Raynsford (2000) as the set of procedures which creates a competitive and profitable industry for the delivery of built assets which create the potential to cater for changing users in the future, enhance the quality of life in communities and create support for social and natural environments. Bueren and Priemus (2002) also describe sustainable construction as 'The design, development, construction, and management of real estate such that the negative environmental effects of the construction, restructuring, and management of the built environment are reduced as far as possible' while Kibert (2008) defines SC as 'how the construction industry together with its product the built environment, among many sectors of the economy and human activity, can contribute to the sustainability of the earth including its human and non-human inhabitants'. The most recent definitions of Sustainable Construction may be from Shen et al. (2010) which describes SC as 'the various methods in the process of implementing construction projects that involve less harm to the environment (i.e. prevention of waste production), increased reuse of waste in the production of construction material (i.e. waste management) and beneficial to the society, and profitable to the company' with Robichaud and Anantatmula (2011) describing SC as 'a philosophy and associated project and construction management practices that seek to:

1. Minimise or eliminate impacts on the environment, natural resources and non-renewable energy sources to promote the sustainability of the built environment;
2. Enhance the health, wellbeing and productivity of occupants and whole communities;
3. Cultivate economic development and financial returns for developers and whole communities; and
4. Apply life cycle approaches to community planning and development'.

It is realized the most of the definitions for sustainable construction refer to the design and construction of construction projects only. According to Pearce (2003) however, a holistic definition of sustainable construction must include property and its management. It is important to realize that sustainable construction is concerned with the life cycle of the 'construction', rather than the lifetime of the 'project' (Gunatilake, 2013). As noted by Hill and Bowen (1997), it is important to realise that although SC incorporates the word 'construction', it describes a process that starts well before the physical construction phase and continues after that as well.



**Figure 2.2: Life time of project vs. Life time of construction (Parkin, 2000)**

Economic effects of construction industry, according to CIB (2002) report, the construction industry with its structure, organizational structure, and performance has a potential which can increase economic sustainability. However, because national organizations cannot compete with international organizations due to globalization, depending on becoming widespread of import material usage; financial decisions cannot be hold inside the country and GNP decreases. Construction industry which is not efficient in economic respect, it also cannot support environmental sustainability because of producing much wastes and not using resources efficiently. Construction industry can increase life quality of low incoming people substantially with job opportunities thanks to its labour intense nature. It can contribute development of social sustainability by service for preventing poverty in the society (CIB & UNEP-IETC, 2002 in Yilmaz and Bakis, 2015). People however need a lot of buildings for sustaining their lives during civilization. These facilities cause a lot of environmental problems during their construction, operation and maintenance, and destruction. Buildings consuming huge amount of energy and natural resource have impact on climate change by affecting quality of air and water in cities (Vyas et. al., 2014).

The UK Government's strategy for more sustainable construction (DETR, 2000b) suggests ten key factors for action by the construction industry by widening these basic objectives.

These include:

- i. design for minimum waste;
- ii. applying lean construction principles;
- iii. minimizing energy in construction and use;
- iv. pollution reduction;
- v. preservation and enhancement of biodiversity;
- vi. conservation of water resources;
- vii. respect for people and local environment; and

- viii. setting targets,
- ix. monitoring and
- x. reporting, in order to benchmark performance (Khalfan, 2006)

### **2.2.1 Environmental Sustainable Construction**

Companies are producing environmental and sustainability reports' and corporate social responsibility is becoming part of accepted business practice (BRE, 2005). The activities of the construction sector and its end products have significant impacts on the environment. The major environmental impacts of construction include, energy consumption, air (e.g. dust and gas) emissions, waste generation, noise pollution, land use, existing site dereliction, habitat destruction, the use of natural resources, the use of water resources, and water discharges (Tam et al., 2006).

Worldwide, the construction industry is responsible for more than one third of total energy usage and the associated Green House Gas (GHG) emissions. The United Nations Environment Programme (UNEP) has reported that 30-40 % of all primary energy used worldwide is in buildings (Cheng et al., 2008; Circo, 2008 cited in Gunatilake, 2013). Although many people address environmental sustainability only as the impact of construction activities on the environment which propagates the prevention of harmful and potentially irreversible damages to the environment, few have taken this further and considered environmental sustainability to include the 'restoring or enhancing' the environment where possible and not just concerned not just with 'preventing' harmful effects on the environment by careful use of natural resources and minimising waste (Adetunji et al., 2003, BRE, 2002). The environmental costs of construction are not limited to the physical construction phase, but accrue over the entire life cycle of the construction (Circo, 2008).

Principles of environmental sustainability of construction found in literature include (Anink et al., 1996; Dair and Williams, 2006; DETR, 2000; Hill and Bowen, 1997; Venters et al., 2005 cited in Gunatilake, 2003);

- i. Minimization of resource consumption - includes energy (especially carbon based), water, materials and land.
- ii. Maximization of resource re-use/recycling.
- iii. Use of renewable resources in preference to non-renewable resources.
- iv. Extract fossil fuels and minerals, and produce persistent substances foreign to nature, at rates which are not faster than their slow redeposit into the Earth's crust
- v. Protecting and enhancing the earth's vitality and bio-diversity.
- vi. Creation of a healthy and non-toxic environment by minimizing pollution.
- vii. Pursuit of quality in creating the built-environment.
- viii. Minimize damage to sensitive landscape.

Below is the Minimum Environmental Sustainability standard as stated by the Building and Construction Authority (2010);

1. The minimum environmental sustainability standard of building works shall have a level of environmental performance that meets the minimum Green Mark score and the stipulated pre-requisite requirements.
2. The minimum Green Mark score for building works related to a residential building is 50 points. Similarly, the minimum Green Mark score for building works to a non-residential building is also 50 points.
3. For mixed-use buildings consisting of residential and non-residential building criteria. The Green Mark scores for respective building categories should meet at least 50 points. For smaller projects where the GFA of either building category is less than

2000m<sup>2</sup>. The computation of the Green Mark score can be based solely on the appropriate assessment criteria for the one with larger applicable Gross Floor Area (GFA) as summarized in the table below;

Project Type	Total New GFA Residential (m <sup>2</sup> )	Total New GFA Non-Residential (m <sup>2</sup> )	GM Score Residential Applicable	GM Score Non-Residential Applicable
Mixed-Use Building	≥ 2000	≥ 2000	Yes	Yes
	≥ 2000	< 2000	Yes	No
	< 2000	≥ 2000	No	Yes
	< 2000	< GFA for Residential	Yes	No
	< GFA for Non-Residential	< 2000	No	Yes

**Table1. 1 Applicable Criteria for Mixed-Use Building with GFA less than 2000m<sup>2</sup> (BCA, 2010)**

### 2.2.2 Economic Sustainable Construction

The construction industry is a very crucial aspect of a nation's economy. The industry is noted as an important factor to enable governments achieve many of their policies (Bosher et al., 2007). Economic sustainability as stated by Adetunji et al. (2003) is the contribution of the construction industry towards the achievement of high level maintenance and unwavering levels of economic growth through an increase in productivity.

Issues of sustainability need to be considered to help in the reduction of some major risks associated with construction. This could be done through reducing costly planning and processing delays, making buildings more accessible and resisting pressure groups. The construction industry which is mostly intensive with regards to labour is also a major source of employment in many countries (Construction Products Association, 2007).

Economic sustainable principles related to construction which are found in literature are; Gunatilake, 2013);

- i. Selecting of environmentally responsible contractors and suppliers.
- ii. Supporting local businesses.
- iii. Ensure financial affordability for beneficiaries through the reduction of overemphasizing technical sustainability.
- iv. Enhancing efficiency and adopting competitive practices and policies.
- v. Through investing in the proceedings from using non-renewable resources in the society, and
- vi. Promoting the creation of employment through construction to be able to keep financial contributions in local hands.

### **2.2.3 Social Sustainable Construction**

Pawlowski (2008) sights the social sustainability element as an area that could undergo degradation in a like manner as the natural environment. He states that the environment is made up of a huge number of factors which include, the living conditions of the people, their customs and traditions, spiritual and cultural beliefs and interpersonal relations. There the social aspects of sustainable construction could be seen as addressing the needs in relation to the factors mentioned above, of those people that are directly or indirectly involved in the construction at the different phases of its life cycle. This could include the clients or users of the facility, employees of the construction firm, suppliers and the local community. Addressing social concerns over the life span of construction is particularly difficult because unlike manufactured products, buildings or constructed facilities have considerably longer life span (Gunatilake, 2013). Construction is arguably the main industry that creates a physical stock of infrastructure and possibly determines are way of living for up to one hundred years or more after its establishment (Pollington, 1999). Buildings are able to have a weighty impact on the health of its occupiers. There has been found to have two to five times more pollutants in indoor air as compared to outdoor air. The poor quality of air within

buildings is noted to cause various health risks such as asthma, legionnaire's disease and cancers and people spend approximately 90% of the entire lives in buildings (Baum, 2007 and BRE, 2002). The Population Reference Bureau (2012) have estimated seventy percent of the world's population to be living within urban areas by the year 2050.

Listed below are some various philosophies of social sustainability within the construction industry as found in literature. Social sustainability aids in;

- a. Protecting and promoting health through healthy and safe working environments
- b. Developing human resources
- c. Providing satisfactory local services and facilities
- d. Respecting and treating stakeholders fairly
- e. Abiding by ethical trading standards and policies for fairness at work
- f. Providing fair and equitable distribution of social costs and benefits of construction
- g. Uplifting the image of communities
- h. Integrating development within the communities
- i. Providing structures that meet the needs of the customers
- j. Conserving local culture and heritage
- k. Improving the quality of human life (Sjostrom, 2001; Hill and Bowen, 1997; Dair and Williams, 2006 as cited in Gunatilake, 2013).

The social aspects of sustainable construction can therefore be seen as concerned with the ethical, legal and moral duties of the construction industry to all its stakeholders (Adetunji et al., 2003)

### **2.3 PROJECT MANAGEMENT AND SUSTAINABILITY**

A project can be defined as “a temporary endeavour undertaken to create a unique product or service” or as a finite piece of work directed to achieve a stated business benefit within certain defined cost and time constraints (Labuschagne, 2005).

On the role of Project Management in sustainable development, Sabini (2016) sites an example of the need of prominent professionals to aid in the building of sustainable societies and economies. This is relevant because professionals such project managers have the technical knowledge and skill needed to create and implement sustainable initiatives successfully. As economic activities are majorly based on projects, there must be the need to make projects more sustainable which could provide a firm foundation for a more sustainable economy and society (Sabini, 2016).

Scott (2008) commented that the connection between project management and sustainability concepts therefore create the need to;

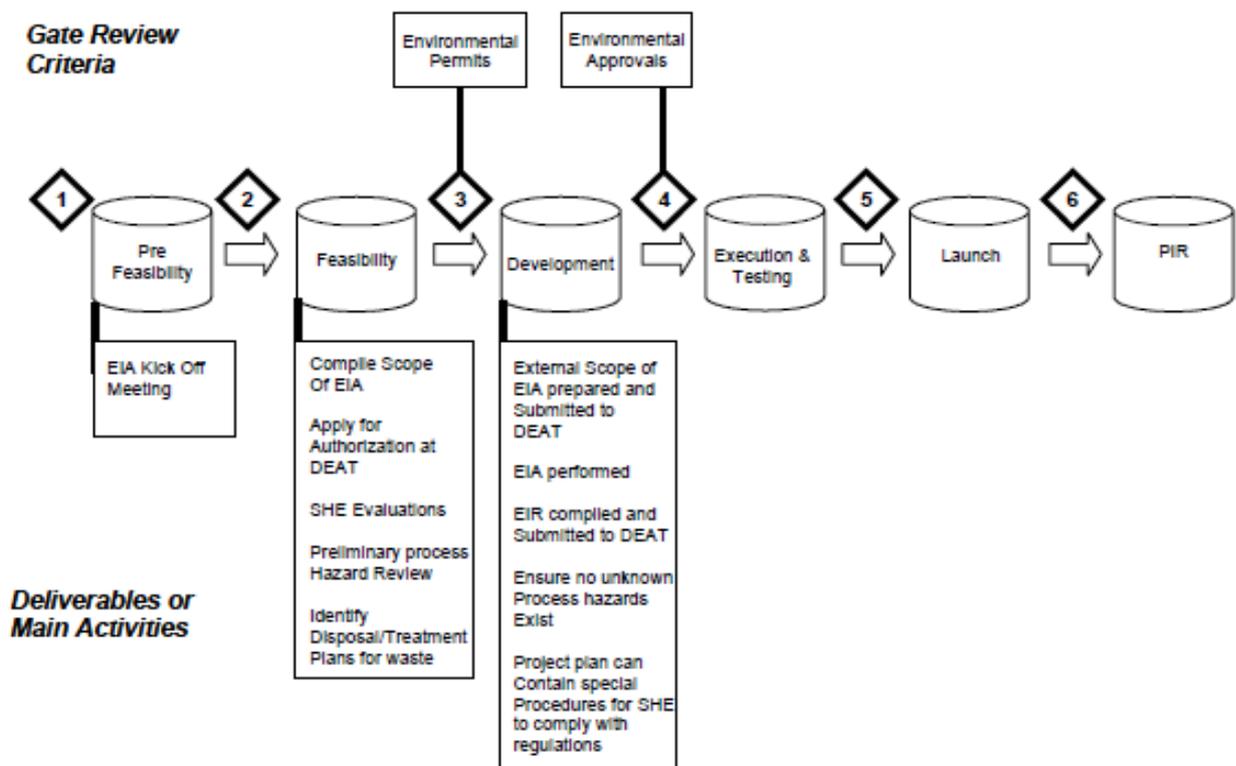
- Manage the complexity and dynamics of projects,
- Continuously adjust the boundaries of projects, and
- Contribute to the optimization of the business case of the investment initialized by the project.

In other words, the involvement of institutional change is an important factor as the technical factors in the building of a sustainable economy and society (Scott, 2008).

For projects to support sustainable development, the concepts of sustainable development must incorporated in the planning and management of the project over its entire life cycle. Projects affect and are affected by the environment they are situated in (physical as well as social environment) and these factors need to be considered from the initiating phase through to its completion. Aspects of sustainable development should therefore be a part of the major

deliverables and activities of each project phase. The environmental, social and economic aspects, also known as the triple bottom line, should be used when appraising projects (Labuschagne, 2005).

The figure below shows the extent of environmental and social considerations in a project's life cycle.



**Figure 2.3: Extent of Environmental and Social Considerations in the Life Cycle of Projects (Labuschagne, 2005)**

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 INTRODUCTION**

This section defines every procedure that was undertaken to realize the objectives for this study. The procedures that were adopted including how the data was taken, where they were obtained the method that was used to obtain the sample size and all information relevant to the needed data are discussed.

#### **3.2 RESEARCH PROCEDURES**

The procedure for the research took the form of a literature review and survey using the questionnaire approach. The research was carried out in three stages in order to achieve the aims and objectives of the research. The initial stage was to undertake a literature search on previous publications on the effect of project management on sustainable development in Ghana. The Literature review was carried out throughout the whole research project. Many literature sources and references such as, research journals, government publications, past dissertations and Internet resources were used. In the intermediate stage, questionnaires were developed basically on the project objectives, the project objectives will translated into specific questions. The questionnaires were in four main parts in order of sequence as follows:

- (a) The first set of question is to categorize respondents to the main parameters in the industry. The purpose is to determine the answers they give based on the role they play during the implementation of Sustainable development practices in construction projects.
- (b) Background information – collecting the personal data of respondents, their experience in the construction industry.

(d) The perception of construction professionals with to Project Management and its relation with Sustainable Development – collecting the respondents’ familiarity with the concept of Sustainable Development with Project Management practices in the Ghanaian construction industry.

Finally, the results of the questionnaire was analyzed using statistical concepts and the results was used to form a basis for recommendations as well as areas for further research.

### **3.3 RESEARCH STRATEGY**

The study was conducted in the Greater Accra region of Ghana. Most of the large construction firms are known to be located in Greater Accra which is the fastest growing city in the country with 65% of the huge construction projects (Narh, 2012).

In Ghana, building and civil engineering works contractors are registered and licensed by the Ministry of Water Resources, Works and Housing. According to the Association of Building and Civil Engineering Contractors of Ghana, there are a total of 96 registered contractors in the greater Accra Region as of December, 2010. Out of which 38 are D1K1 contractors the classification is based on their financial classes.

### **3.4 STUDY POPULATION**

The study population is D1K1 construction firms in the Greater Accra Region of Ghana, which according to the Association of Building and Civil Engineering Contractors of Ghana, has a total number of 38 D1K1 construction firms.

### **3.5 QUESTIONNAIRE STRUCTURE**

The development of this questionnaire was primarily to source information from construction professionals within the Greater Accra region. The structure of the questionnaire is shown in the Appendix. The questionnaire survey is divided into four parts. The first part consists of

general information like type of firm and experience in the construction industry. The second part seeks to understand the general knowledge of construction experts on economic, social and environmental sustainable development goals in construction as well as their knowledge of the project management processes. The third part will pairs up the sustainable development goals with the first three project management processes namely; the Initiating, Executing and Planning Phases to know which of the sustainable development goals are considered during these project management phases.

### **3.6 SAMPLING TECHNIQUE**

Purposive sampling was used to select participants from the list of D1K1 construction firms that was provided by the Association of Building and Civil Engineering Contractors of Ghana, Accra chapter.

### **3.7 DETERMINATION OF SAMPLE SIZE**

The study was limited to contractors in classes of D1K1 only due to the type and size of projects they have handled, which mostly involve a huge amount of planning. From Ministry of Water Resources, Works and Housing, there are 38 D1K1 contractors in Accra alone. The sample size was determined using the Kish formula;

$$n = \frac{n1}{1+(n1/N)}$$

Where n = minimum sample size

$$n1 = S^2 / V^2 \quad S^2 = (P) (1-P)$$

N = total population (population proportion) = 38

S = Maximum standard deviation in the population elements.

P = Proportion of the population elements that belong to the defined category = 0.5 at 95% confidence level, and

V = Standard error of the sampling distribution = 0.05

Therefore;

$$S^2 = 0.5(1-0.5)$$

$$S^2 = 0.25$$

$$V^2 = 0.05^2$$

$$V^2 = 0.0025$$

$$n^1 = 0.25 / 0.0025$$

$$n^1 = 100$$

Therefore;

$$n = \frac{100}{1+(100/38)}$$

$$n = 100 / 3.632$$

$$n = 27.533$$

Therefore minimum sampling size (n) = 28

### **3.8 Data Presentation and Analysis**

The data was edited, coded and entered into a computer equipped with the Statistical Package for Social Scientists (SPSS) version 16.0. The data was further presented and organized into tables and charts using Microsoft Excel.

The data was analyzed using frequency and average index analysis. Frequency analysis was used primarily to show the percentages of the outcomes while the average index used the likert scale of three ordinal measures of agreement ranging from Not considered (1) to Considered (3) to present the responses from the respondents.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 INTRODUCTION**

The result of the questionnaire was analyzed with a focus on construction firms within the Greater Accra Region. Questionnaires were distributed to 28 respondents among the key construction professionals. This chapter presents the results of the analysis and discussions in the form of text, figures and tables.

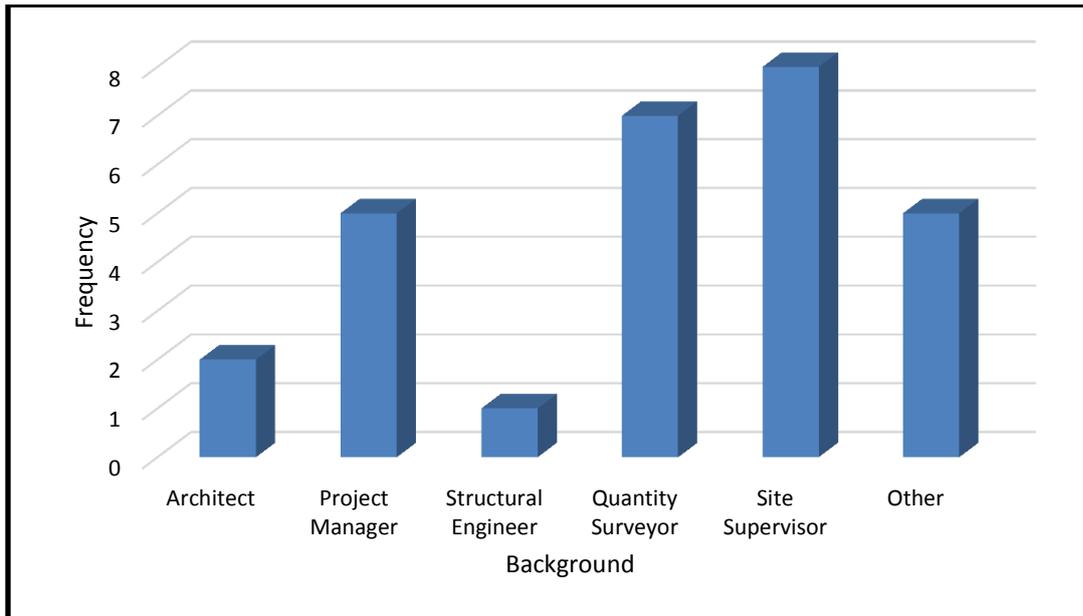
#### **4.2 DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS**

The question for this section were to find out the respondents position in the firm they worked with, their years of organizational experience, their awareness of sustainable construction as well as the concepts of sustainable development and their knowledge of the project management life-cycle.

The respondents were divided into six categories; Architects, Project Manager, Structural Engineer, Quantity Surveyor, Site Supervisor and others. The demographic characteristics of the respondents showed that the majority of the 28.6% were site supervisors, followed by quantity surveyors with 25%, 17.9% Project Managers, 17.8% Other professionals, 7.1% Architects and 3.6% being structural engineers. Also, 53.6% of the respondents stated they had 6-10years experience, 35.7% had 1-5 years' experience and 10.7% had over 20years experience in the construction industry.

<b>Professional Background</b>	<b>Frequency</b>	<b>Percentage (%)</b>
Architect	2	7.1
Project Manager	5	17.9
Structural Engineer	1	3.6
Quantity Surveyor	7	25
Site Supervisor	8	28.6
Other	5	17.8
<b>Total</b>	<b>28</b>	<b>100</b>

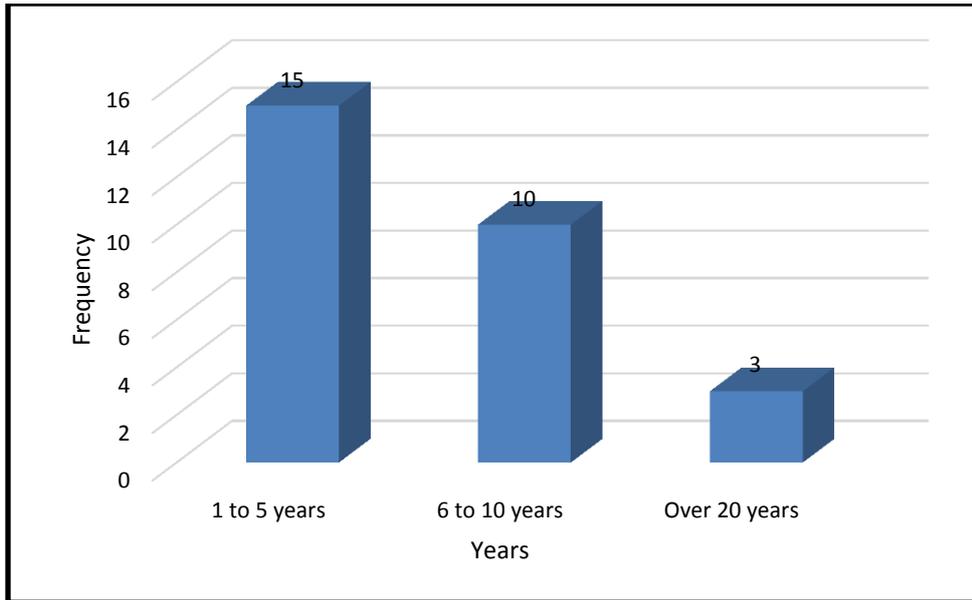
**Table 4.1 Professional Background of Respondents**



**Figure 4.1 Professional Background of Respondents**

<b>Years of Experience</b>	<b>Frequency</b>	<b>Percentage (%)</b>
1 to 5 years	15	35.7
6 to 10 years	10	53.6
Over 20 years	3	10.7
<b>Total</b>	<b>28</b>	<b>100</b>

**Table 4.2 Respondents years of Experience**



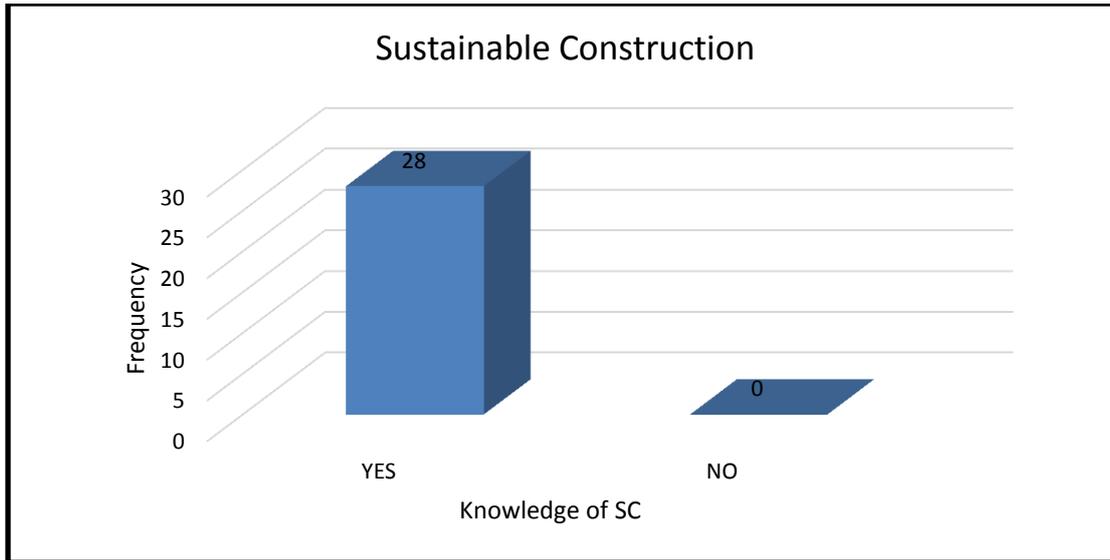
**Figure 4.2 Respondents years of Experience**

#### **4.3 KNOWLEDGE OF SUSTAINABLE CONSTRUCTION, SUSTAINABLE DEVELOPMENT CONCEPTS AND PROJECT MANAGEMENT LIFE-CYCLE**

All the respondents stated they had knowledge of the term sustainable construction, generating a 100% Yes response. With the concept of sustainable construction however, 41.4% responded to have knowledge of the Environmental sustainability concept, 31% had knowledge of Economic sustainability concept and 27.6% had knowledge of the Social sustainable concept. 85.7% of the respondents noted they had knowledge of the project management processes/ life-cycle while 14.3% had no knowledge of the processes. Tables 4.3, 4.4 and 4.5 show the respondents responses with respect to their knowledge of sustainable construction, sustainable development concepts and the knowledge of the project management life-cycle respectively.

<b>Sustainable Construction</b>	<b>Frequency</b>	<b>Percentage (%)</b>
YES	28	100
NO	0	0
<b>Total</b>	<b>28</b>	<b>100</b>

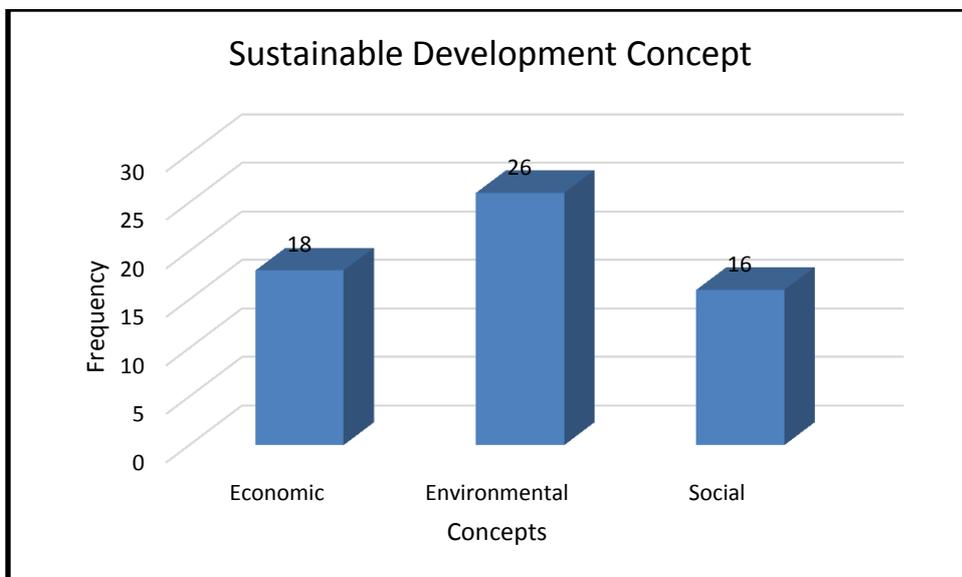
**Table 4.3 Knowledge of Sustainable Construction**



**Figure 4.3 Knowledge of Sustainable Construction**

Sustainable Concept	Frequency	Percentage (%)
Economic	18	31
Environmental	26	41.4
Social	16	27.6
<b>Total</b>	<b>60</b>	<b>100</b>

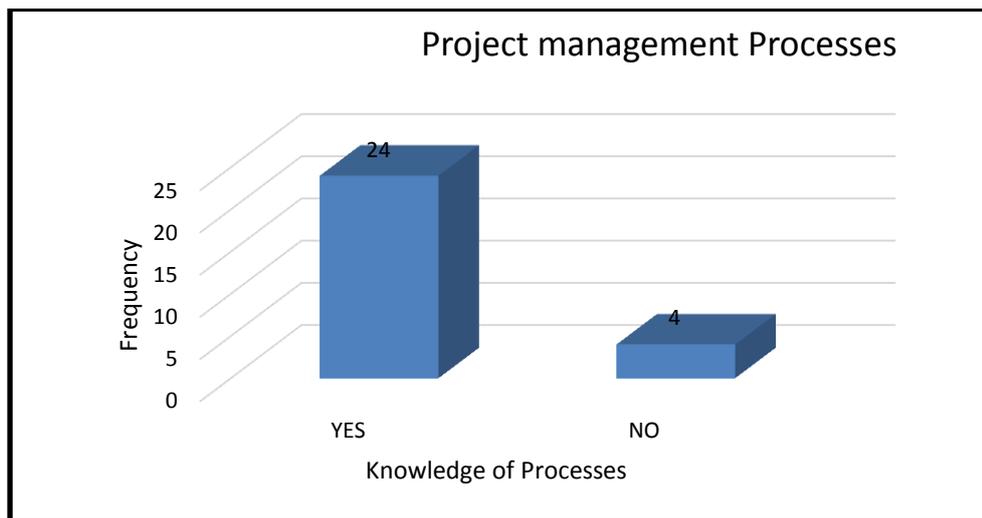
**Table 4.4 Knowledge of Sustainable Development Concept**



**Figure 4.4 Knowledge of Sustainable Development**

Project Management Processes	Management	Frequency	Percentage (%)
YES		4	14.3
NO		24	85.7
<b>Total</b>		<b>28</b>	<b>100</b>

**Table 4.5 Knowledge of Project Management Processes/ Life-cycle**



**Figure 4.5 Knowledge of Project Management Processes/ Life-cycle**

#### **4.4 SUSTAINABLE DEVELOPMENT CONCEPT ADOPTED THE FIRST THREE PHASES OF THE PROJECT MANAGEMENT LIFE-CYCLE**

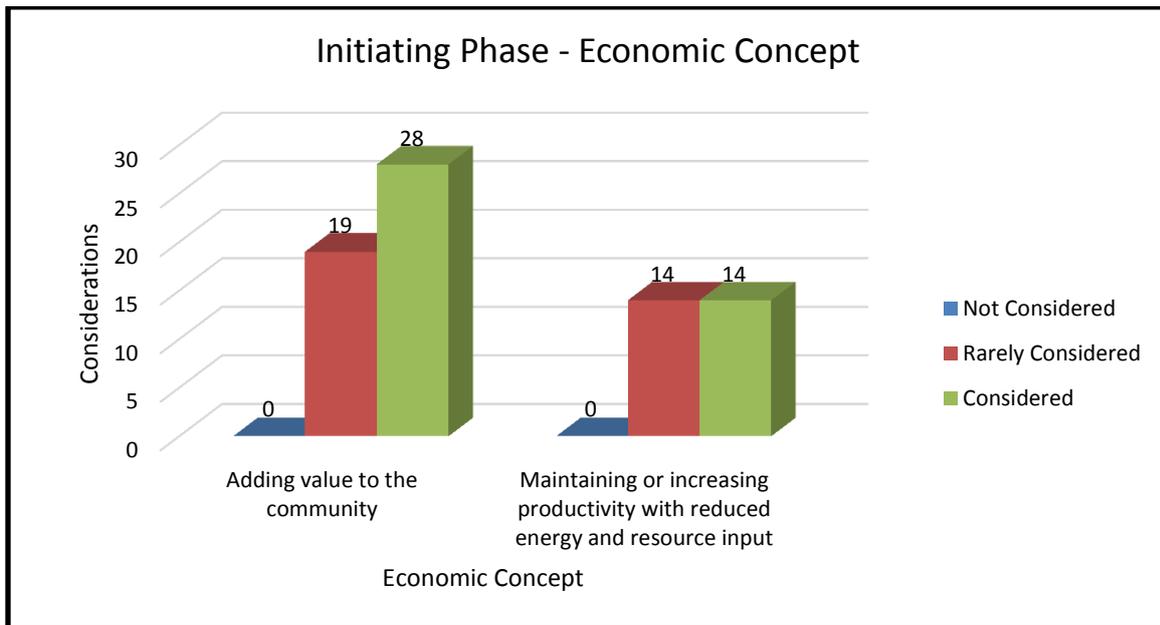
This sub-section examines the sustainable concepts which are most considered within the first three project management life-cycle/ processes for Ghanaian construction projects. The processes are, the Initiating Phase, Planning Phase and the Executing Phase.

##### **4.4.1 INITIATING PHASE**

Table 4.9 and Figure 4.9 examines the economic sustainability concepts which are considered during the initiating phase of construction projects. It is realized that considerations are mostly given to adding value to the community and maintaining or increasing productivity with reduced energy and resource input during the initiating phase.

<b>INITIATING PHASE- ECONOMIC CONCEPT</b>					
<b>Adding value to the community</b>			<b>Maintaining or increasing productivity with reduced energy and resource input</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>		<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	0	0	Not Considered	0	0
Rarely Considered	9	32.1	Rarely Considered	14	50
Considered	19	67.9	Considered	14	50
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

**Table 4.9 Initiating Phase- Economic Concept**



**Figure 4.9 Initiating Phase- Economic Sustainable Concept**

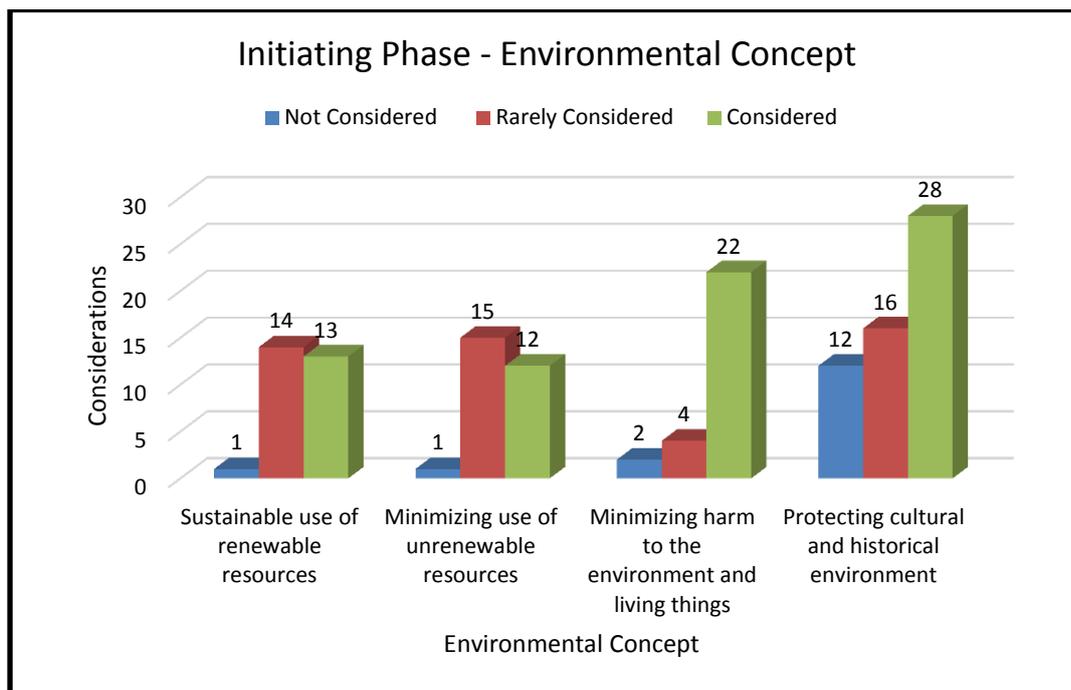
With the environmental concept as seen in Table 4.10 and Figure 4.10 however, considerations are given to minimizing harm to the environment and protecting cultural and historical environment while having a sustainable use renewable resources and minimizing use of unrennewable resources are rarely considered.

<b>INITIATING PHASE - ENVIRONMENTAL CONCEPT</b>					
<b>Sustainable use of renewable resources</b>			<b>Minimizing use of unrennewable resources</b>		
	<b>Frequency</b>	<b>Percentage (%)</b>		<b>Frequency</b>	<b>Percentage (%)</b>
Not Considered	1	3.6	Not Considered	1	3.6
Rarely Considered	14	50	Rarely Considered	15	53.6
Considered	13	46.4	Considered	12	42.8
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

<b>INITIATING PHASE - ENVIRONMENTAL CONCEPT</b>					
<b>Minimizing harm to the environment and living things</b>			<b>Protecting cultural and historical environment</b>		
	<b>Frequency</b>	<b>Percentage (%)</b>		<b>Frequency</b>	<b>Percentage (%)</b>
Not Considered	2	7.1	Not Considered	0	0
Rarely Considered	4	14.3	Rarely Considered	12	42.9
Considered	22	78.6	Considered	16	57.1
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

**Table 4.10 Initiating Phase- Environmental Sustainable Concept**



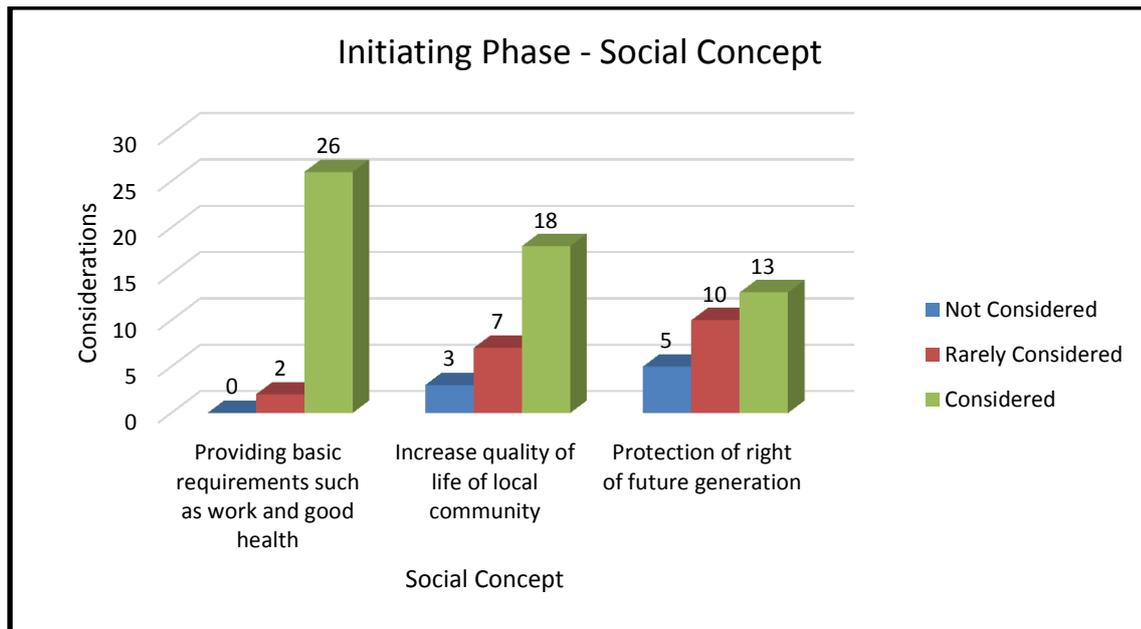
**Figure 4.10 Initiating Phase- Environmental Sustainable Concept**

<b>INITIATING PHASE - SOCIAL CONCEPT</b>					
<b>Providing basic requirements such as work and good health</b>			<b>Increase quality of life of local community</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>		<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	0	0	Not Considered	3	10.7
Rarely Considered	2	7.1	Rarely Considered	7	25
Considered	26	92.9	Considered	18	64.3
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

<b>INITIATING PHASE - SOCIAL CONCEPT</b>		
<b>Protection of right of future generation</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	5	17.9
Rarely Considered	10	35.7
Considered	13	46.4
<b>Total</b>	<b>28</b>	<b>100</b>

**Table 4.11 Initiating Phase- Social Sustainable Concept**



**Figure 4.11 Initiating Phase- Social Sustainable Concept**

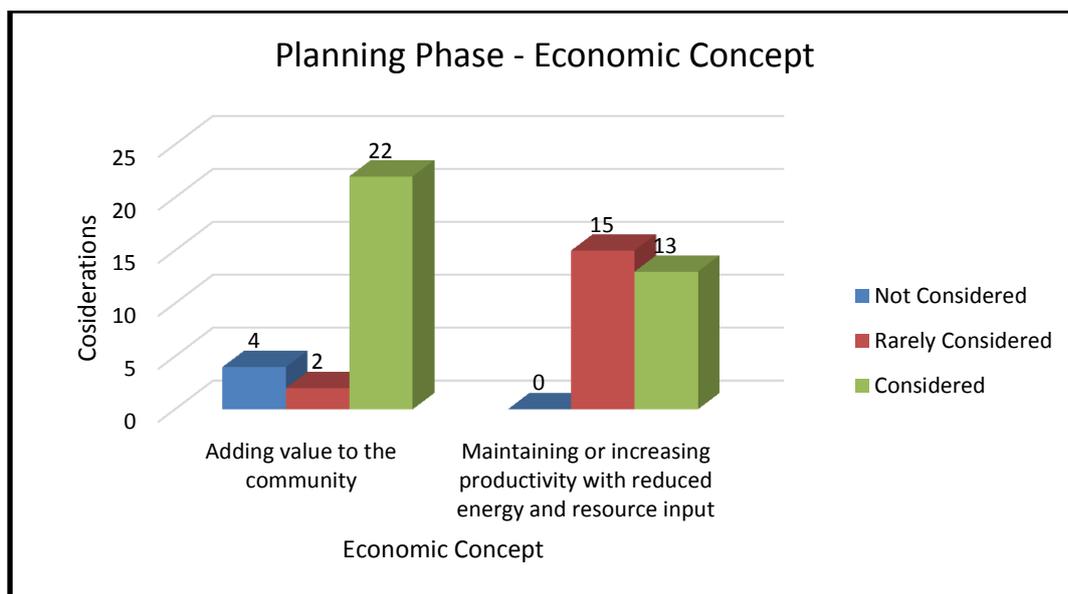
Social sustainable concepts such as providing basic requirements such as work and good health, increase in quality of life of local community and protection of right of future generation are considered during the initiating phase as seen in Table 4.11 and Figure 4.11.

#### 4.4.2 PLANNING PHASE

With regards to the Economic sustainable concepts during the Planning phase, consideration is give mostly to adding value to the community while maintaining or increasing productivity with reduced energy and resource is rarely considered as seen in Table 4.12 and Figure 4.12 below. The environmental sustainable concept as seen in Table 4.13 and Figure 4.13 below consider sustainable use of renewable resources and minimizing harm to the environment and livings, with minimizing use of unrenewable resources and protecting cultural and historical environment being rarely considered.

<b>PLANNING PHASE- ECONOMIC CONCEPT</b>					
<b>Adding value to the community</b>			<b>Maintaining or increasing productivity with reduced energy and resource input</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>		<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	4	14.3	Not Considered	0	0
Rarely Considered	2	7.1	Rarely Considered	15	53.6
Considered	22	78.6	Considered	13	46.4
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

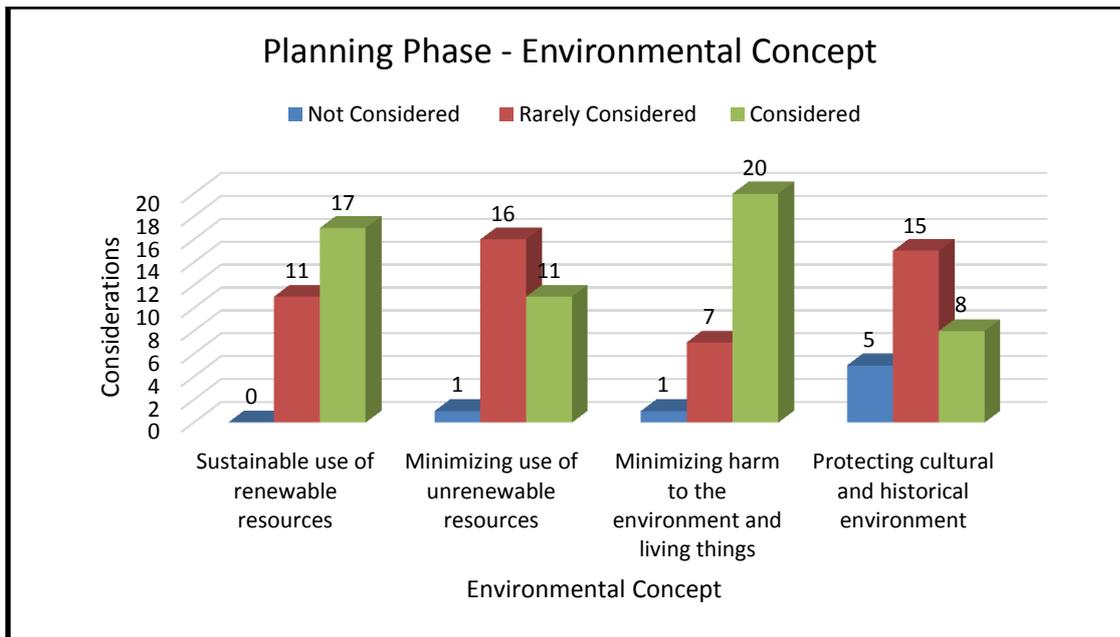
**Table 4.12 Planning Phase- Economic Sustainable Concept**



**Figure 4.12 Planning Phase- Economic Sustainable Concept**

<b>PLANNING PHASE - ENVIRONMENTAL CONCEPT</b>					
<b>Sustainable use of renewable resources</b>			<b>Minimizing use of unrenewable resources</b>		
	<b>Frequency</b>	<b>Percentage (%)</b>		<b>Frequency</b>	<b>Percentage (%)</b>
Not Considered	0	0	Not Considered	1	3.6
Rarely Considered	11	39.3	Rarely Considered	16	57.1
Considered	17	60.7	Considered	11	39.3
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>
<b>PLANNING PHASE - ENVIRONMENTAL CONCEPT</b>					
<b>Minimizing harm to the environment and living things</b>			<b>Protecting cultural and historical environment</b>		
	<b>Frequency</b>	<b>Percentage (%)</b>		<b>Frequency</b>	<b>Percentage (%)</b>
Not Considered	1	3.6	Not Considered	5	17.8
Rarely Considered	7	25	Rarely Considered	15	53.6
Considered	20	71.4	Considered	8	28.6
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

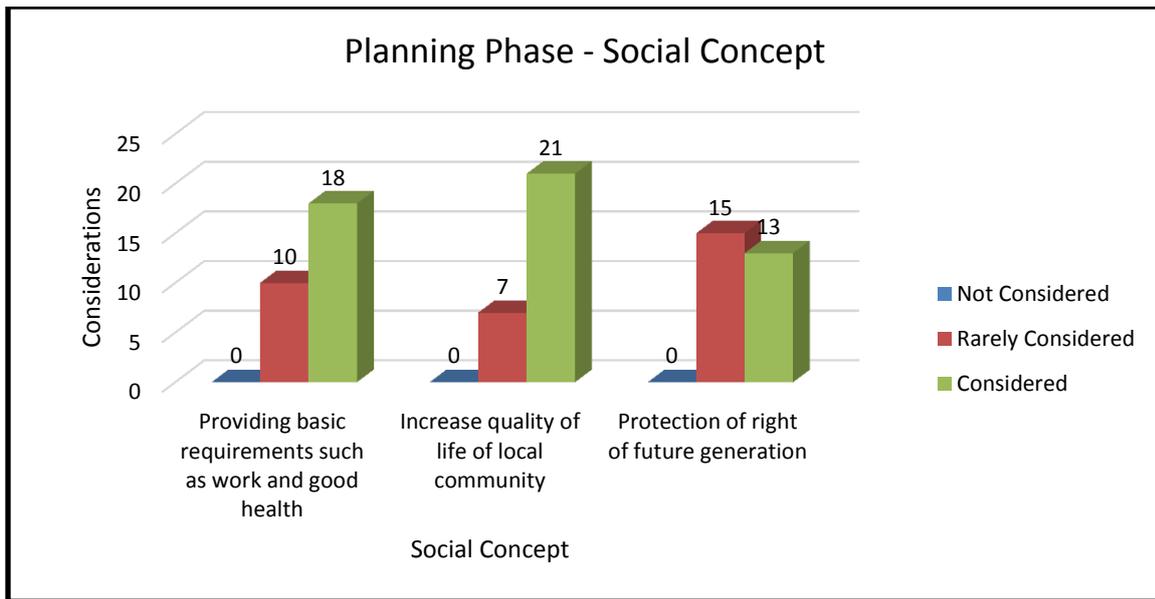
**Table 4.13 Planning Phase- Environmental Sustainable Concept**



**Figure 4.13 Planning Phase- Environmental Sustainable Concept**

<b>PLANNING PHASE - SOCIAL CONCEPT</b>					
<b>Providing basic requirements such as work and good health</b>			<b>Increase quality of life of local community</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>		<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	0	0	Not Considered	0	0
Rarely Considered	10	35.7	Rarely Considered	7	25
Considered	18	64.3	Considered	21	75
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>
<b>Protection of right of future generation</b>					
	<b>Frequenc y</b>	<b>Percentage (%)</b>			
Not Considered	0	0			
Rarely Considered	15	53.6			
Considered	13	46.4			
<b>Total</b>	<b>28</b>	<b>100</b>			

**Table 4.14 Planning Phase- Social Sustainable Concept**



**Figure 4.14 Planning Phase- Social Sustainable Concept**

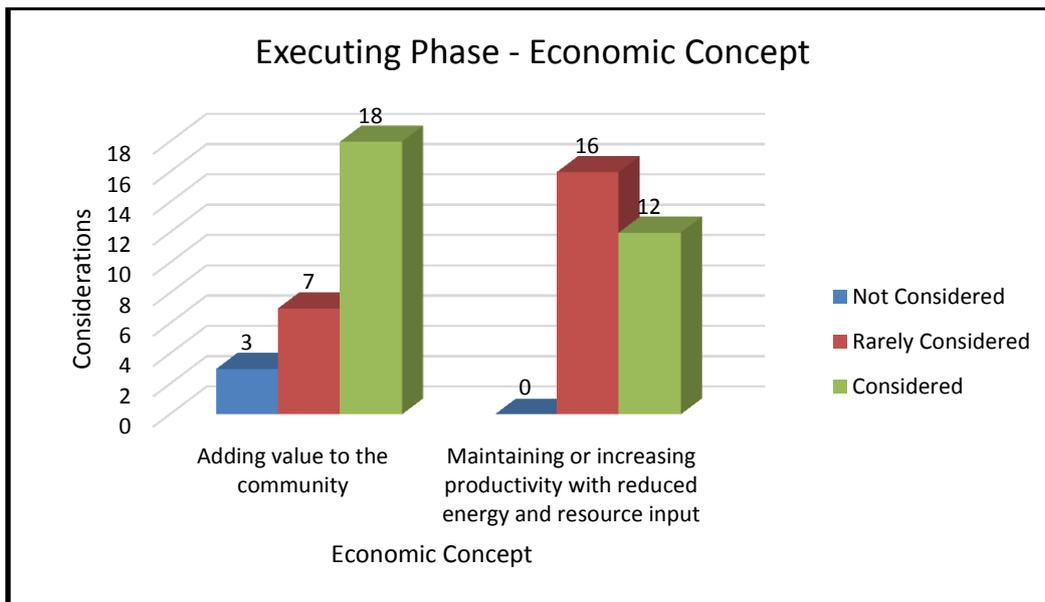
Table 4.14 and Figure 4.14 examine the social sustainable concepts which are considered during the planning phase of construction projects and it realized that considerations are given to providing basic requirements and increasing quality of life of the local community while the protection of the right of future generation is rarely considered.

#### **4.4.3 EXECUTING PHASE**

With regards to the Economic sustainable concepts during the Executing phase, consideration is also given to adding value to the community while maintaining or increasing productivity with reduced energy and resource is rarely considered as seen in Table 4.15 and Figure 4.15. The environmental sustainable concept as seen in Table 4.16 and Figure 4.16 inform that sustainable use of renewable resources, minimizing harm to the environment and living things and protecting cultural and historical environment are considered with minimizing use of unrennewable resources being rarely considered.

<b>EXECUTING PHASE- ECONOMIC CONCEPT</b>					
<b>Adding value to the community</b>			<b>Maintaining or increasing productivity with reduced energy and resource input</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>		<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	3	10.7	Not Considered	0	0
Rarely Considered	7	25	Rarely Considered	16	57.1
Considered	18	64.3	Considered	12	42.9
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

**Table 4.15 Executing Phase - Economic Sustainable Concept**



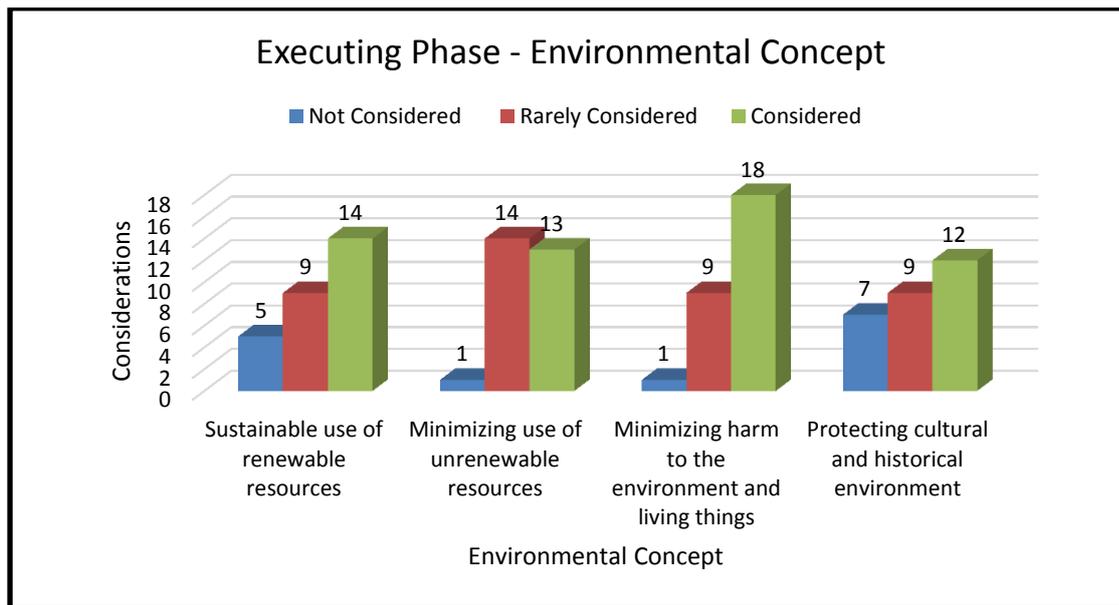
**Figure 4.15 Executing Phase - Economic Sustainable Concept**

<b>EXECUTING PHASE - ENVIRONMENTAL CONCEPT</b>					
<b>Sustainable use of renewable resources</b>			<b>Minimizing use of unrennewable resources</b>		
	<b>Frequency</b>	<b>Percentage (%)</b>		<b>Frequency</b>	<b>Percentage (%)</b>
Not Considered	5	17.9	Not Considered	1	3.6
Rarely Considered	9	32.1	Rarely Considered	14	50
Considered	14	50	Considered	13	46.4
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

<b>EXECUTING PHASE - ENVIRONMENTAL CONCEPT</b>					
<b>Minimizing harm to the environment and living things</b>			<b>Protecting cultural and historical environment</b>		
	<b>Frequency</b>	<b>Percentage (%)</b>		<b>Frequency</b>	<b>Percentage (%)</b>
Not Considered	1	3.6	Not Considered	7	25
Rarely Considered	9	32.1	Rarely Considered	9	32.1
Considered	18	64.3	Considered	12	42.9
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>100</b>

**Table 4.16 Executing Phase - Environmental Sustainable Concept**

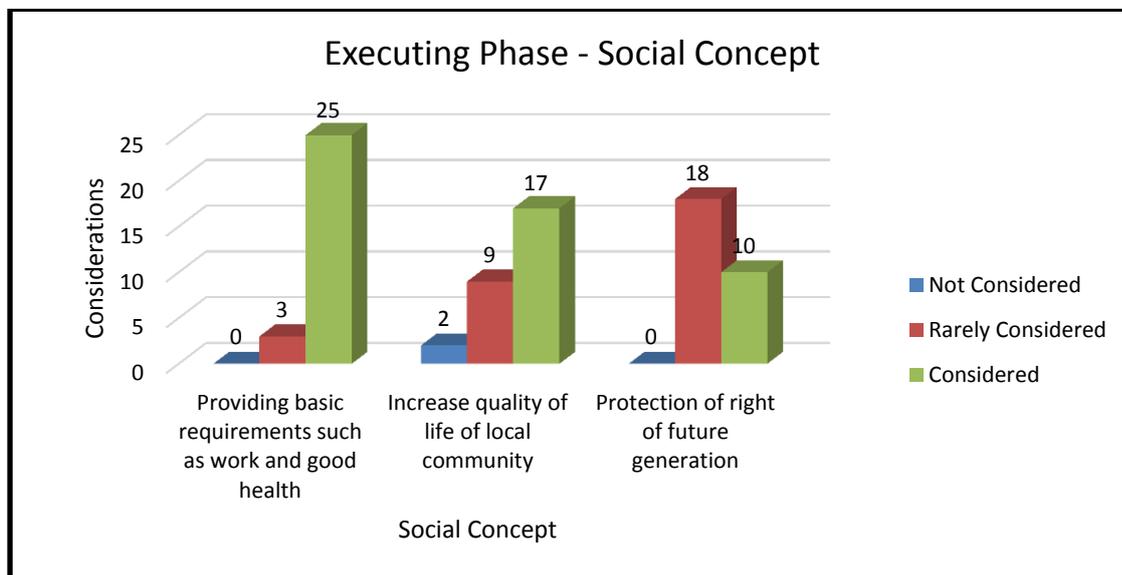


**Figure 4.16 Executing Phase - Environmental Sustainable Concept**

The social sustainable concepts as shown in Table 4.17 and Figure 4.17 indicate that considerations are given to providing basic requirements and increasing quality of life of the local community while the protection of the right of future generation is rarely considered.

<b>EXECUTING PHASE - SOCIAL CONCEPT</b>					
<b>Providing basic requirements such as work and good health</b>			<b>Increase quality of life of local community</b>		
	<b>Frequenc y</b>	<b>Percentage (%)</b>		<b>Frequenc y</b>	<b>Percentage (%)</b>
Not Considered	0	0	Not Considered	2	7.1
Rarely Considered	3	10.7	Rarely Considered	9	32.1
Considered	25	89.3	Considered	17	60.7
<b>Total</b>	<b>28</b>	<b>100</b>	<b>Total</b>	<b>28</b>	<b>99.9</b>
<b>Protection of right of future generation</b>					
	<b>Frequenc y</b>	<b>Percentage (%)</b>			
Not Considered	0	0			
Rarely Considered	18	64.3			
Considered	10	35.7			
<b>Total</b>	<b>28</b>	<b>100</b>			

**Table 4.17 Executing Phase - Social Sustainable Concept**



**Figure 4.16 Executing Phase - Social Sustainable Concept**

In general, it realized that a lot of considerations are given to sustainable concepts during the Initiating phase of projects. These considerations however reduces as the project gets to the planning and executing phases.

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 INTRODUCTION**

This chapter summarizes the important findings related to the aim and objectives of the research, the processes that were adopted to accomplish the objectives is also provided. Conclusions derived from the findings with recommendations for the academic community and practitioners in the industry are also stated at the end of the chapter.

#### **5.2 RESEARCH PROCESSES ADOPTED**

The aim of the research was to provide an understanding to the field of sustainable construction by construction professionals within the Ghanaian construction industry and to develop a framework that can assist in providing knowledge of existing considerations of sustainable development concepts taken during the first three processes of the project management life-cycle in construction projects in Ghana. The objectives set for the achievement of the aim was;

1. To identify the sustainable development concepts considered during the first three phases of the project management life-cycle in the Ghanaian construction industry.
2. To identify the factors that influences sustainable development in decision making.
3. To identify how project management decisions can influence sustainable development goals.

### 5.3 FINDINGS OF THE STUDY

The aim of this research was to identify the possible areas of economic, social and environmental concepts of sustainable development which are considered during the Initiating, Planning and Executing phases of the project management life-cycle within the Ghanaian construction industry. A total number of 65 questionnaires were received out of the 80 questionnaires distributed to construction professionals within the Greater Accra region of Ghana giving an 81.3% response rate. The findings of this study in relation to the aim and objectives are as follows;

1. With the Economic sustainability concept, it was realized that most construction professionals gave considerations to the areas of “Adding value to the community” and “Maintaining productivity with reduced energy and resource inputs” during the Initiating and Planning phases of the project management life-cycle with 52 professionals and 58 professionals having considerations for these options respectively. Although the values for consideration were still high during the Executing phase, the values reduced with 50 professionals considering “Adding values to the community” and 45 professionals considering “Maintaining productivity with reduced energy and resource inputs”.
2. With considerations to the Environmental sustainable concepts, the areas of Minimizing use of renewable resources, Minimizing harm to the environment and Protecting cultural and historical environment had 45 professionals, 57 professionals and 45 professionals respectively considering these options during the Initiating Phase with the values gradually reducing through the phases of the project management life-cycle with 19, 32, and 35 professionals given considerations to these options during the executing phase. The option of Sustainable use of renewable resources had 44 professionals considering the option during the Initiating phase which increased to 47

considerations during the Planning phase. The value however reduced to 39 considerations during the Executing phase.

3. Finally with the Social sustainability concept, 58 professionals gave considerations to the option of 'Providing basic requirements such as work and good health' during the Initiating phase which increased to 62 consideration during the Executing Phase. This therefore becomes the only option which had an increase in considerations through the progression through the project management life-cycle. The options of 'Increasing the quality of life of the local community' and 'Protecting the right of future generations', 57 and 46 professionals respectively considered these options during the Initiating phase which reduced to 21 and 31 considerations respectively during the Executing phase.

## **5.4 CONCLUSION**

The challenge of the construction sector these days does not only have to do with completing projects within the estimated budget, time and at the best quality but to also find a fine balance between the many limitations within the building processes such as the social, environmental and economic need (Atombo et al., 2015). The study reviewed existing literature on sustainable development and informs on various forms of sustainability with regards to the three main sustainable development concepts, namely, the Economic sustainability, environmental sustainability and social sustainability which is also known as the three-bottom-line. The study further informs of various sustainability concepts in relation to the construction industry and how their incorporation within the construction industry can aid in enhancing the wellbeing of the building's occupants as well the community the structure is situated, minimizing any hazardous impact on the environment both during and after the construction of the building and providing economic development and financial returns to the developers of the structure and the entire community.

From the analysis, apart from the option of ‘Providing basic requirements such as work and good health’ which has an increase in considerations from the Initiating to the Executing phase of the project management life-cycle, all other options of the sustainable development concepts have reductions to their number of considerations with construction professionals as projects progresses from the Initiating phase to the Executing phase of the project management life-cycle.

## **5.5 RECOMMENDATIONS**

The following are suggestions to the companies based on the conclusion;

1. Trainings and seminars should be held for construction professionals to duly inform them on the need for incorporating sustainable development goals in the construction industry. This will duly aid in easy communication and will reduce the decision making time since all or most of the workers shall have knowledge of the sustainability needs of each building they may construct.
2. There must be a conscious effort to incorporate sustainable goals to each construction project. This could be done by setting target ranges of sustainability for major activities within the construction processes.
3. All professionals must be actively involved in the planning of construction projects in order to produce all the needs of each project with regards to sustainable development.
4. The construction firms can also employ specialists on sustainable development to liaise with the firms projects managers to properly draw out sustainable development goals and plans for each project.

## **5.6 SUGGESTIONS FOR FUTURE STUDY**

1. Reasons for considering each sustainable development concept during the phases of the project management life-cycle in the construction industry.
2. Reasons for not considering the concept of sustainability during the initiating phase of project management in the construction industry.

## REFERENCES

- Adetunji, I., Price, A., Fleming, P. and Kemp, P., (2003). Sustainability and the UK construction industry - a review. *Proceedings of the Institution of Civil Engineers, Engineering Sustainability*, 156 (4), 185-199
- Attah N. V. (2010). *Environmental Sustainability and Sustainable Growth: A Global Outlook*.
- Atombo C., Dzantor J. C. K., Agbo A. A., 2015. *Integration of Sustainable Construction in Project Management: A Case Study in Ghana*. *International Journal of Construction Engineering and Management*
- Baum, Mara, 2007. *Green building research funding: an assessment of current activity in the United States*. US Green Building Council.
- Brundtland, G. H., (1987). *Our Common Future: Report of the World Commission on Environment and Development*. Oxford: Oxford University Press
- BRE, 2002. *MaSC guide: profiting from sustainability*. London: BRE.
- Bosher, L, Carrillo, P, Dainty, A, Glass, J, and Price, A (2007). *Realizing and resilient and sustainable built environment: towards a strategic agenda for the United Kingdom*. Disasters.
- Building and Construction Authority (2012). *Code of Environmental Sustainability of Buildings – 3<sup>rd</sup> Edition. Section 3.4*
- Cheng, C, Pouffary, S, Svenningsen, N, and Callaway, M (2008). *The Kyoto protocol, The Clean Development Mechanism and the building and construction sector: a report for the UNEP Sustainable Buildings and Construction Initiative*. Paris: United Nations Environment Programme.
- Circo, C. J., 2008. Using Mandates and Incentives to Promote Sustainable Construction and Green Building Projects in the Private Sector: A Call for More State Land Use Policy Initiatives. *Penn State Law Review*, 112.
- Daly, H. E., and J. B. Cobb, Jr. 1989. *For the Common Good: Redirecting the Economy toward Community, the Environment and a Sustainable Future*. Boston: Beacon Press.

- Du Plessis, C. (2002). Agenda 21 for sustainable construction in developing countries: a discussion document. *Pretoria, South Africa: The International Council for Research and Innovation in Building Construction (CIB) and United Nations Environmental Programme International Environmental Technology Centre (UNEP-IETC)*
- Drexhage J, Murphy D (2010) Sustainable development: from Brundtland to Rio 2012, Background paper for the high level panel on global sustainability, United Nations, New York.
- Dyllick T, Hockerts K (2002) Beyond the case for corporate sustainability. *Bus Strat Environ* 11
- Elkington, J. (1997). *Cannibals with forks. The triple bottom line of 21st century business*, Oxford: Capstone.
- EnvironmentalScience.org (2018). What is Sustainability and why is it important? <https://www.environmentalscience.org/sustainability>
- Gray R (2010). Is accounting for sustainability actually accounting for sustainability and how would we know? An exploration of narratives of organisations and the planet. *Account Org Soc* 35(1):47–62
- Gunatilake S. (2013). *The Uptake and Implementation of Sustainable Construction: Transforming Policy into Practice*.
- Hill, R C, and Bowen, P A (1997) Sustainable construction: principles and a framework for attainment. *Construction Management and Economics*
- HKU Architecture. (2002). *Sustainable Architecture and Building Design, Report*, Hongkong.
- Houkara, E. (2007). *Ulkesel Kouullara Uygun Surdurulebilir YapOm ocin Stratejik Ycnetim Modeli, (Doktora Tezi)*. ostanbul Teknik Universitesi Fen Bilimleri Enstitüsü, ostanbul.

- Khalfan, M. M. A., (2006). Managing sustainability within construction projects. *Journal of Environmental Assessment Policy and Management*
- Kibert, C. J., (2008). *Sustainable construction: Green building design and delivery*. 2 ed. New Jersey: John Wiley and Sons
- Labuschagne, C (2005). Sustainable Project Life Cycle Management: Development of social criteria for decision-making.
- Luca Sabini (2016). *Project management and Sustainability*. New Castle University Business School.
- Malik M.A. Khalfan. (2002). “*Sustainable Development and Sustainable Construction*”: A Literature Review on C-San D Project. Department of Civil Engineering, Loughborough University.
- Pawlowski, A., (2008). How many dimensions does sustainable development have? *Sustainable Development*.
- Pearce, D., 2003. *The social and economic value of construction: The construction industry's contribution to sustainable development*. London: nCRISP - The Construction Industry Research and Innovation Strategy Panel.
- Population Reference Bureau, 2012. *Human population: urbanisation*. Washington, USA: Population Reference Bureau. Available from: <http://www.prb.org/Educators/TeachersGuides/HumanPopulation/Urbanization.aspx>
- Raynsford, N., 2000. Sustainable construction: the government's role. *Proceedings of the Institution of Civil Engineers-Civil Engineering*, 138, 16-22
- Robichaud, L. B. and Anantatmula, V. S., 2011. Greening project management practices for sustainable construction. *Journal of Management in Engineering*, 27 (1), 48-57

- Gareis R, Huemann M, Martinuzzi A, et al (2013). *Project Management and Sustainable Development Principles*. Newtown Square: Project Management Institute, Inc.
- Gareis, R., Heumann, M. and Martinuzzi, A. (2009). *Relating Sustainable Development and Project Management*. IRNOP IX, Berlin.
- Goodland R. (2002). *Sustainability: Human, Social, Economic and Environmental*. Article on Encyclopedia of Global Environmental Change.
- Martin J. Williams (2017). *Unfinished Development Projects in Ghana: Mechanising Collective Choice*.
- Narh J. (2012). Risk management practices of construction firms within the Ghanaian Construction Industry.
- Pollington, C (1999) Legal and procurement practices for sustainable development. *Building Research and Information*
- Sabini L. (2016). Project management and Sustainability. New Castle University Business School.*
- Scott, W. R. (2008). Lords of the Dance: Professionals as Institutional Agents. *Organization Studies*, 29(2), 219–238.
- Sev, A. (2009). *Surdurulebilir Mimarlık (1. Baskı)*. İstanbul: YEM Yayınları, İstanbul.
- Silvius A.J.G., Schipper R., et al (2012). *Sustainability in Project Management Competencies: Analyzing the Competence Gap of Project Managers*. Gower Publishing
- Shobayo Peter B., Elumah Lucas O. (2017). *Evaluating the Role of Project Management on Sustainable Development*. *Pakistan Research Journal*.
- Silvius A.J.G., Schipper R. (2014). *Sustainability in project management: A literature review and impact analysis*.
- Tam V W Y, Tam C M, Zeng X S and Ng W C Y (2006) —Towards adaptation of prefabrication in construction, *Built and Environment*.

UNDP (2018). Sustainable development goals.

Vyas, S., Ahmed, S., & Parashar, A. (2014). BEE (Bureau of energyefficiency) and Green Buildings, *International Journal of Research*, 1, 23 -32.

World Commission on Environment and Development (1987). *Our Common Future*. Oxford: Oxford University Press. p. 27.

Yilmaz M. and Bakis A. (2015). Sustainability in Construction Sector. World Conference on Technology, Innovation and Entrepreneurship

## APPENDIX

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF ART AND BUILT ENVIRONMENT

Department of Building Technology

(MSc. Project Management)

### Survey Questionnaire

THE EFFECT OF PROJECT MANAGEMENT ON SUSTAINABLE

CONSTRUCTION IN GHANA

Dear Sir/Madam

This questionnaire forms part of an MSc. Research project which aims to **acquire knowledge on the sustainable development concepts considered construction firms in Ghana during the Initiating, Planning and Execution Phases of the Project Management life-cycle.**

Project management has become very relevant in the success of sustainable development goals especially in the construction industry by aiding professionals within the industry to construct much more environmental friendly structures. The results of this study will aid in identifying the various sustainable development concepts adopted by Construction Professionals during the Initiating, Planning and Executing phases of construction projects.

Completion of the questionnaire is completely voluntary and returning the completed questionnaire will be considered as your consent to participate in the survey. The questionnaire will take you about 10 minutes to complete.

**Kindly note; the information provided to this survey will be used solely for academic purposes and would be treated as strictly confidential.**

I appreciate the time taken off your busy schedule to contribute to this survey. In the event of questions or queries, please do not hesitate to contact me. Thank you for your time and valid contribution in advance.

Yours faithfully,

RICHARD DADZIE  
MSc. Researcher  
Email: rddadzie92@gmail.com  
Tel: 0271826408

## SECTION A: RESPONDENT'S PROFILE

Kindly respond to the listed questions by ticking [√] in the appropriate box for each item where necessary.

1. Please indicate your name (Optional):

.....

2. Kindly state the position you hold in the firm.

- a. Consultant [ ]
- b. Project Manager [ ]
- c. Structural Engineer [ ]
- d. Quantity Surveyor [ ]

3. How many years of professional experience do you have?

- a. 1 – 5 years [ ]
- b. 6 – 10 years [ ]
- c. 11 – 15 years [ ]
- d. 16 – 20 years [ ]
- e. Over 20 years [ ]

4. Are you familiar with the term “Sustainable Construction”?

- a. Yes [ ]
- b. No [ ]

5. Kindly tick the Sustainable Development concept you are aware of. Please tick as many as you are aware of.

a. Economic (Profit) [ ]

b. Environmental (Planet) [ ]

c. Social (People) [ ]

6. Do you know of the Project Management processes/ life-cycle?

a. Yes [ ]

b. No [ ]

**SECTION B: UNDERSTANDING THE SUSTAINABLE DEVELOPMENT CONCEPTS ADOPTED WITHIN THE FIRST THREE PHASES OF THE PROJECT MANAGEMENT LIFE-CYCLE.**

Below are likely concepts of sustainable development regarding construction projects. From your experience, kindly indicate the sustainable development concept adopted within your organization at each of the stated project management life cycle phases.

**Use the scale: 1 = Not Considered 2 = Rarely Considered 3 = Considered**

7. The **Initiating Phase** determines how feasible the project will be. It helps determine the needs and objectives of the project

Sustainable Development Concepts	Initiating Phase		
	1	2	3
<b>Economic Concept</b>			
Adding value to the community			
Maintaining or increasing productivity with reduced energy and resource input			
<b>Environmental Concept</b>			
Sustainable use of renewable resources			
Minimizing use of unrenowable resources			
Minimizing harm to the environment and living things			
Protecting cultural and historical environment			
<b>Social Concept</b>			
Providing basic requirements such as work and good health			
Increase quality of life of local community			
Protection of right of future generation			

8. The **Planning Phase** aids in determining the entire scope of the project which includes decisions on budget, timelines, resources needed and a description on how the project will be executed.

Sustainable Development Concepts	Planning Phase		
	1	2	3
<b>Economic Concept</b>			
Adding value to the community			
Maintaining or increasing productivity with reduced energy and resource input			
<b>Environmental Concept</b>			
Sustainable use of renewable resources			
Minimizing use of unrenewable resources			
Minimizing harm to the environment and living things			
Protecting cultural and historical environment			
<b>Social Concept</b>			
Providing basic requirements such as work and good health			
Increase quality of life of local community			
Protection of right of future generation			

9. The **Executing Phase** entails carrying out the details of the works to meet the planned needs of the project.

Sustainable Development Concepts	Executing Phase		
	1	2	3
<b>Economic Concept</b>			
Adding value to the community			
Maintaining or increasing productivity with reduced energy and resource input			
<b>Environmental Concept</b>			
Sustainable use of renewable resources			
Minimizing use of renewable resources			
Minimizing harm to the environment and living things			
Protecting cultural and historical environment			
<b>Social Concept</b>			
Providing basic requirements such as good health			
Increase quality of life of local community			
Protection of right of future generation			