
**AN INVESTIGATION OF SUSTAINABLE BUILDING
CONSTRUCTION PRACTICES IN ZAMBIA**

BY

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DECLARATION

I, **Gomezga Gregory Mtonga**, do declare that this dissertation is entirely my own work, except as specified in acknowledgements, and that neither the dissertation nor original work contained herein has been submitted to this or any other institution for the higher degree.

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Date.....

Lusaka, Zambia.

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CERTIFICATE OF APPROVAL

This dissertation by Gomezga Gregory Mtonga has been approved as fulfilling the requirements for the award of the degree of Master of Engineering in Construction Management by the University of Zambia.

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ABSTRACT

Since the Earth Summit held in Brazil in 1992 when agenda 21 was formulated as the international blueprint for sustainable development, all sectors of society have been in the process of interpreting and pursuing sustainability and sustainable development within their specific contexts. However, the Zambian construction industry has not seen much of sustainable building construction principles being put into practice. Therefore, the objectives of this research were to: examine the current construction (building) practices in Zambia; explore the fundamental principles of sustainable construction practices; to identify the main challenges in implementing sustainable construction practices in the Zambian Construction Industry; and make recommendations for strategies that could be taken to promote sustainable construction in the Zambian Construction Industry. This study was conducted through a survey research design and made use of both qualitative and quantitative modes. A random sample of thirty-five (35) professionals and stakeholders of the 50 targeted were used for the study. The results indicated that, 14% of the respondents have excellent level of awareness on sustainable construction while 86% have a good level and the aim of achieving a sustainably built environment calls for excellence. Results on current construction practices indicate organization/firms putting more preference (37%) on the economic aspect of construction, while the professionals (51%) feel the environmental aspects should be the ones prioritised. In conclusion, the status of sustainable construction in Zambia is still in its infancy. The lack of awareness/training is among the major barriers for sustainable construction practices. Besides the need for capacities, technologies and tools, ardent commitment by all players in the construction industry including the government and the public is required to achieve sustainable construction in the Zambian Construction Sector.

Key words: Sustainable Building Construction, Sustainable Building Concepts, Sustainable Development.

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DEDICATION

To my Mum, Family, and friends

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LIST OF ABBREVIATIONS

CaGBC	Canadian Green Building Council
CIB	International Council for Research and Innovation in Building and Research
CO ₂	Carbon Dioxide
EIZ	Engineering Institution of Zambia
GDP	Gross Domestic Product
GRIHA	Green Rating for Integrated Habitat Assessment
GSCM	Green Supply Chain Management
LEED	Leadership in Energy and Environmental Design
MSMEs	Micro Small and Medium Scale Enterprises
NCC	National Council for Construction
SBC	Sustainable Building and Construction
SBC	Sustainable Building and Concepts
SIZ	Surveyors Institute of Zambia
SPSS	Statistical Package for Social Research
USGBC	United States Green Building Council
WCED	World Commission on Environment and Development
ZCI	Zambia Construction Industry
ZEMA	Zambia Environmental Management Authority
ZGJP	Zambia Green Jobs Programme
ZIA	Zambia Institute of Architects
ZIP	Zambia Institute of Planners

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

Buildings on their own account for one sixth of world's freshwater withdrawals, one quarter of its wood harvest and two thirds of its material and energy flows (Cai, et al, 2019). Their structures impact on areas beyond their immediate locations affecting water sheds, air quality, transport patterns of communication among other things (Cai et al., 2019). As the world population continues to grow, the implementation of resource efficient measures in all areas of human activity is imperative, and the concept of sustainable development can be used as a basis for enhancing the understanding of sustainable construction (Nwokoro and Onukube, 2011).

Sustainable or green buildings use less energy, water and natural resources compared to the conventional buildings. They also create less waste and provide healthier living environment, further they incorporate features such as efficient use of water, energy efficient and eco-friendly environment. The buildings use renewable energy and recycled materials, embrace effective use of landscape, and have improved indoor quality for health and comfort (Roy and Gupta, 2008).

In the United States more than 30 states and regional programs promote some level of energy efficiency and environmental responsibility for the residential construction (Reposa, 2009). The green buildings have been marketed as economical and as alternatives to conventional buildings (Issa et al., 2011), and the total number of commercial green buildings commissioned has hit the ten thousandth mark (World Architecture News, 2011).

In Canada more than 212 green buildings have been accredited since 2010 (CaGBC, 2010) whereas in India the green concept has taken root with two green rating systems namely Leadership in Energy and Environmental Design green rating system (LEED) and Green Rating for Integrated Habitat Assessment (GRIHA) already in use. In the developing world such as Africa, sustainable construction has not received sufficient attention despite being an important aspect of sustainable development (Adebayo, 2000). Locally, the Zambia Green Jobs Programme (ZGJP) in collaboration with the National Council for Construction aim to provide technical and development assistance to enable Micro Small and Medium Scale

Enterprise (MSMEs) to enhance competitiveness and sustainable business in the construction Industry (Zambia Green Jobs Programme, 2013).

The combination of rapid population growth, urbanization and economic development are putting the African continent at risk with regards to meeting the increasing demands for housing and urban planning (De Boeck, 2013). Although the construction industry could form the bedrock for possible solutions to the developmental challenges (Ebohon and Rwelamila, 2001), accounting for more than 29% of the Gross Domestic Product in Zambia (African Economic Outlook country note on Zambia, 2020) while growing, year-on-year, faster than the already rapidly expanding Zambian economy, their significant contributions to sustainability challenges in society and the biosphere as a whole have been little emphasized in Africa (Adebayo, 2002). The need to develop appropriate strategies and actions to make the construction activities in the region more sustainable is of great importance to society (Djokoto et al., 2017).

Sustainable design and building construction is concerned with implementing sustainable development at the scale of individual sites and buildings. It takes account of the resources used in construction, and of the environmental, social, and economic impacts of the construction process itself and of how buildings are designed and used. Thus, while consideration of energy and carbon impacts is an important element, sustainable design and construction goes wider than this. In summary, it seeks to: minimise the use of resources (including energy and water); ensure that the built environment mitigates and is resilient to the impact of climate change; protect and enhance biodiversity and green infrastructure; provide buildings and spaces that are pleasant and healthy for occupiers and users; ensure the sustainable sourcing of materials; and minimise waste.

1.2 SUSTAINABLE BUILDING CONSTRUCTION

Sustainability is sometimes used interchangeably with green. Green or sustainable construction is defined as the strategic, transparent, integration and achievement of social, environmental, and economic objectives in the systemic coordination of construction process for improving the long-term performance of buildings (Wu et al., 2019). Sustainable construction is the one in which the construction companies in today's competitive environment understand the needs of current generations and offer them efficient and effective solutions that achieve their objectives without compromising new generations from achieving their own needs (Othman et al, 2010). Bob Hansen in Dow Corning magazine

stated that sustainable construction also aims at ensuring that buildings have long-term purpose even those that are built for one-time events.

Ultimately, the concerns of sustainable construction go beyond the serviceability of a building during its lifetime, but also the recycling of resources to reduce waste streams associated with demolition is also given an important consideration. Increasing energy efficiency for the life of the building is also a key, as is minimizing waste in the construction of a building through recycling and design. The four principal attributes which construction sustainability depends on are social, economic, biophysical, and technical (Xiao, 2005). In the light of achieving sustainable construction, Green Supply Chain Management (GSCM) has been adopted as an antidote (Ojo et al, 2018). Green supply chain management aims to maximize overall environmental profit by adopting a life cycle approach through product design, material selection, manufacturing, and sales and recovery, and therefore helps the construction industry to realize its sustainable development and improvement (Shi et al., 2012). GSCM has become popular and notable concept in sustainable construction because it largely takes environmental elements into consideration.

The term ‘sustainable construction’ is generally used to describe a process which starts well before construction (in the planning and design stages) and continues after the construction team have left the site. According to the World Commission on the Environment and Development (WCED, 2014), sustainability is a form of development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainability construction/design goes far beyond simply creating products that benefits consumer in terms of better air environment, cost savings and durability, rather effective sustainable construction/design must illustrate a thorough understanding of a full systems approach of products in their environment and interaction, with other products, as well as the effect on many other factors. Sustainability should be viewed as a process and not just a goal that allow a broader evaluation over time of the environmental, economic, and societal impacts of buildings products (Ojo et al., 2019). Viewing sustainability as a process is essential for green construction/designs as specifiers are challenged to evaluate the full life cycle of construction products (Ojo et al., 2019).

The sustainability aspects in the built environment are generally concentrated on reducing the environmental footprint of buildings. Sustainable buildings are assessed by: (1) reduced production of greenhouse gas emissions (particularly carbon dioxide); (2) reduced use of

natural resources, in particular, water, gas and electricity; (3) reduced waste production and increased recycling; (4) enhanced building occupant health, comfort, and safety; (5) production of renewable resources; (6) collection of water for potable and non-potable uses; and (7) recycling and treatment of sewage and waste water. Furthermore, sustainable construction can be qualified as a special case of sustainable development targeting the construction industry especially, those whose role it is to develop, plan design, build, alter or maintain the built environment, including the building materials manufacturers and suppliers (Adebayo, 2002).

A new approach to sustainable building evolves from the incorporation of the concept ‘sustainable development’ into the real estate and construction industry that provides an integrated approach to environmental, social, and economic dimensions. WCED popularised this concept in the Brundtland Report (1987), indicating that it “meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 1987).

1.3 PROBLEM STATEMENT

Construction industry plays a vital role towards achieving national and international strategies for social and economic development. It contributes towards increasing the GDP, stimulating growth of other industries, and creating job opportunities as well as providing societies with facilities and infrastructure projects that meet their needs and fulfil their requirements but having a major impact on the environment because about 50% of the material resources for construction are taken from nature, 40% of energy consumption and 50% of total waste generated (Othman, 2010). According to the U.K. Green Building Council (2014) the construction sector uses more than 400 million tons of material a year. The huge consumption of the resources by construction industry has called for sustainable construction to meet present and future needs.

However, current sustainable construction practices are widely different depending on how the concept of sustainable construction is developed in various countries (Thipparat, 2011). The difference between the market economies, transition economies and developing economies influences its implementation priorities. The mature economies pay attention to a sustainable building stock either by new construction or by refurbishment. In the transition economies the emphasis is on new developments reducing the housing shortage and improving their transportation networks. In the developing economies the social agenda (for

example, job creation) is much higher on the agenda than environmental concerns (Thipparat, 2011). Zambia being a developing economy, with its built environment still developing, measures to promote and start implementing sustainable building construction practices in all manner of construction should be taken well in advance so that future generations are not ‘suffocated’. The construction of commercial buildings has continued to grow within Zambia and unless appropriate measures are put in place, development of unsustainable buildings will not stop.

1.4 RESERCH OBJECTIVE

1.4.1 Main Objective

The main objective of the study was to investigate sustainable building construction practices in Zambia so as to make recommendations for strategies to enable key stakeholders to put into action sustainability principles in the implementation of sustainable building construction projects in Zambia.

1.4.2 Specific Objectives

The following specific research objectives were set for this research study:

- (i) To examine the current construction (building) practices in Zambia;
- (ii) To explore the fundamental principles of sustainable construction practices;
- (iii) To identify the main challenges in implementing sustainable construction practices in the Zambian Construction Industry; and
- (iv) To come up with recommendations for strategies that could be taken to promote sustainable construction in the Zambian Construction Industry.

1.5 RESERCH QUESTIONS

To achieve the outlined purpose, the research focused on finding answers to four related questions:

- (i) What are the common construction practices in Zambia?
- (ii) What are the fundamental principles of sustainable construction practices?
- (iii) What do building/construction professionals see as the primary barriers impeding the use of sustainable construction practices in their professions?
What strategies would be the most efficient and effective in ensuring building professionals adopt sustainable building/construction practices?

1.6 SIGNIFICANCE OF THE STUDY/RELEVANCE TO KNOWLEDGE

The findings of this study contribute valuable knowledge to the field of Architecture, Construction and Engineering as it is one of the few studies undertaken to investigate the extent of adoption of sustainable construction concepts in Zambia. This new knowledge forms a useful reading material to researchers and readers in general. Further, the literature available vary from country to country, this study has put into perspective the greatest challenges in the uptake of sustainable/green building concepts in Zambia.

The study through its recommendations also suggests ways of increasing adoption of sustainability concepts in buildings through change and development of policy. It provides a basis for educating building construction participants in adopting sustainable/green concepts. Lastly the study influences the practice of consultants in the building industry in Zambia. The use of specific findings would improve the quality of buildings regarding sustainability.

1.7 SCOPE AND LIMITATION OF THE STUDY

The research was restricted to experts, stakeholders in the construction industry involved in commercial building projects in the Lusaka and Copperbelt areas of Zambia. Participants considered in this study were limited to those who were involved in the design, construction, and management of the completed commercial buildings within the study area. Respondents included Architects, Quantity Surveyors, Property Managers and Engineers by use of structured questionnaires and reinforced by interviews.

1.8 OUTLINE OF THE STUDY

This dissertation was organized in six (6) chapters; Chapter one (1) outlined the background, aim and objectives of the study. It also suggested the application of the research. The research problem was stated; research questions, and scope and limitations of the study were justified.

Chapter two (2) contained related studies on sustainable/green buildings and discussed various concepts of green buildings adopted in the world and in the Zambian context. The study was then conceptualized, and a general system view of sustainable building construction was adopted.

Chapter three (3) discussed the methodology used in conducting the study. The research design, population, data collection procedures and analysis were also discussed. Chapter four (4) presented the results and analysis of the research findings.

Chapter five (5) presented a detailed discussion of the findings and arguments, and chapter six (6) concludes the study and presents recommendations to the Government of the Republic of Zambia and other stakeholders for implementation and promoting sustainable building construction.

1.9 SUMMARY

Population growth, urbanization and economic development has led to increasing demands for housing and urban planning infrastructure. This has further resulted into increased construction activities which play a vital role towards achieving national and international strategies for social and economic development. However, construction activities have a major impact on the environment with about 50% of the material resources for construction extracted from nature, 40% of energy consumption and 50% of total waste production (Othman, 2010). The construction industry consumes more than 400 million tons of material a year (U.K. Green Building Council, 2014). This huge consumption of the resources by construction industry has called for sustainable construction to meet present and future needs. Therefore, sustainable building in the Zambian Construction Industry will enable the mitigation of negative effects of construction activities on the environmental, promote economic and social wellbeing of society. Sustainable building Construction aims at achieving, reduced production of greenhouse gas emissions; reduced use of natural resources; reduced waste production and increased recycling; enhanced building occupant health, comfort, and safety; production of renewable resources; collection of water for potable and non-potable uses; and recycling and treatment of sewage and wastewater (Adebayo, 2002). This dissertation therefore investigated the practice of sustainable building construction concept in Zambia and makes recommendations for measures to promote these practices. Chapter two (2) reviews literature of other scholars in relation to the concept of sustainable building construction and focusses on key elements in the adoption of sustainable building construction concepts and strategies of enhancing its uptake in Zambia.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter examined previous works related to the study. The review of literature examined research undertaken in relation to the concept of sustainable/green buildings and sustainable construction. It focused on key elements in the adoption of sustainable building construction concepts and strategies of enhancing uptake of the concepts.

2.2 THE CONCEPT OF SUSTAINABLE CONSTRUCTION

Sustainable construction is a cross-cutting issue which has dominated academic discussions globally. The review of related literature shows a variety of definitions exist for the concept and there is inconsistency in terms of scope and context. For straightforwardness, sustainable construction is best described as the subdivision of sustainable development and its application to the construction industry (Langston and Ding, 2019). The construction industry involves all who plan, develop, produce, design, modify or maintain the built environment and includes manufacturers and suppliers of construction materials, clients, contractors, consultants, and end users of facilities (CRISP, 2000). Therefore, sustainable construction could best be described as a subset of sustainable development, which encloses matters such as tendering, site planning and organization, material selection, recycling, and waste minimization (Langston and Ding, 2019). Sustainable construction is defined by some researchers as a construction process which integrates the fundamental themes of sustainable development (Parkin, 2000). Such construction processes would thence bring benefits such as environmental responsibility, social awareness, and economic profitability to society at large (Langston and Ding, 2019).

In most literature, a common definition of sustainable construction is: ‘the creation and responsible management of a healthy built environment based on prudent use of resources and ecological principles’ (Kibert, 1994) and a myriad of other definitions focused more on the environmental aspect of sustainability. Others, for example Wyatt (1994) stated that ‘sustainable construction philosophy requires a ‘cradle to grave’ appraisal of project, which involves managing the serviceability of project during its life- time and eventual deconstruction’, focus on the economic aspect of sustainability. Osaily (2010) posited that sustainable construction is ‘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. Only a few of the existing definitions are comprehensive and capture the entirety of the concept. A good example of this is, 'sustainable construction comprises several processes through which a profitable and competitive industry delivers built assets to improve quality of life and stakeholder satisfaction' (DETR, 2000).

United Kingdom Government's strategy for comprehensive sustainable construction (DETR, 2000) suggests key factors for action by the construction industry by widening the basic themes. These include design for minimum waste; lean construction; minimize energy in construction and use; do not pollute; preserve and enhance biodiversity; conserve water resources; respect people and local environment; and set targets, monitor, and report, to benchmark performance (Langston and Ding, 2019). Construction activities have momentous impact on quality of life: its outputs change the nature, function and appearance of the communities and countryside in which people live and work. However, Osaily (2010) is of the view that the future of sustainable construction has its roots in past and present actions and the future depends on the awareness of the consequences of our acts and deeds.

The construction industry addresses the three dimensions of sustainability; environmental, social, and economic, in different ways (Adetunji et al., 2003). Environmental factors in construction encompass the use of natural resources, waste minimization, and energy and water efficiency to prevent a harmful effect on the environment. Social aspects include taking the stakeholders into account which include employees, suppliers, and the community. Economic factors include the construction industry's contribution to economic growth and employment (Kristy et al., 2006). Implementing sustainability is important in the construction industry because its activities have a large impact on the environment. It is estimated that approximately 37% of the world's total energy consumption is attributed to construction related activities (Rayna, 2005). Construction activities consume approximately half of all the resources humans take from nature (Ibid, 2005). Half of the world's fossil fuel consumption is used to serve buildings. Each year over 420 million tons of resources are used for construction, 6,500 hectares of land is converted from rural to urban, and 90 million tons of construction and demolition waste is generated (Ibid, 2005).

2.3 SUSTAINABLE CONSTRUCTION PRINCIPLES

There are six main principles suggested by Kibert (2004), University of Florida which are as follows:

- (i) Reducing the consumption of resources.
- (ii) Increasing the use of reusable resources.
- (iii) Encouraging renewable and recyclable resource use.
- (iv) Protection of natural habitat.
- (v) Eradicating toxic environment and an environment that is clean and healthy.
- (vi) Attaining quality in construction projects.

These principles however are very bias towards environmental issues. The principles of sustainable building and construction presented by Professor Peter Newman (2002) at the 2002 Barnett Oration, are as follows:

2.3.1 Principle 1: Long Term Economic Health

Due to the long lifespan of construction projects, there is the need to get it right from the beginning because its effects are lasting. All factors that can affect or impact on the environment should be taken very seriously.

2.3.2 Principle 2: Equity and Human Rights

There should be the assurance of human rights and equality in construction projects. Workers on construction projects should be properly remunerated. Health and safety measures should also be considered so that those accidents are reduced on site. The countries labour laws should also be followed to reduce worker agitations. A congenial environment should be created for workers to work cordially. Minority interest should also be protected.

2.3.3 Principle 3: Biodiversity and Ecological Integrity

Raw material source is very important in sustainable construction. Sustainable construction considers sources of raw materials that can be replenished and renewed. There should also be measures such as reforestation to restore the vegetation after use. Construction works should be geared at protecting the eco system.

2.3.4 Principle 4: Settlement Efficiency and Quality of Life

Efficiency in the use of resources is essential. Resources like land should be judiciously used to derive maximum benefits. This will create space for future generations in years to come or the foreseeable future. It will in a long way improve on the quality of life of society through less consumption of energy and reduced waste.

2.3.5 Principle 5: Community, Regions Sense of Place and Heritage

Integration and a sense of community belonging are very important. Construction activities should consider societal norms and culture. Construction should help encourage a sense of communal involvement and prevent isolation and exclusion.

2.3.6 Principle 6: Net benefit for Development

Construction projects should consider economic, social, and environmental benefits to society. In developing society through construction, the environment should be protected and left in the best of shapes or better than it was inherited.

2.3.7 Principle 7: Common good for Planning

The long-term advancement of the community is what sustainable construction seeks to achieve. There should be proper planning with the provision of public services like transport systems and drainage systems in public services.

2.3.8 Principle 8: Integration of the Triple Bottom Line

Evaluation and measurement of success should be based on how the three key bottom lines of social, economic, and environmental issues are tackled and achieved.

2.3.9 Principle 9: Precaution

There should be contingency plans to handle issues of emergency. To achieve this, there should be some level of flexibility in the construction cycle to accommodate new issues.

2.3.10 Principle 10: Accountability, Transparency, and Engagement

An extensive engagement of the public on major construction decisions is important. This will generate support for the project and ensure accountability and transparency. It will also encourage inclusiveness and a sense of belonging.

2.3.11 Principle 11: Hope, Symbolism, and Interactive Change

A construction project brings hope, serves a symbolic purpose, and brings about social and interactive change.

2.4. THE THREE SPHERES OF SUSTAINABILITY

According to the Oak Ridge National Laboratory, the following questions should be asked to determine if a product is sustainable:

- Does it have a long life?
- Does it save energy?
- Does it add durability?
- Does it contribute to the waste stream?
- It is renewable and recyclable.

As shown in figure 2.1 for smooth implementation of sustainable construction, there should be balance in the implementation of the three (03) aspects of environmental, social and economic to achieve sustainability in building construction projects Elizabeth M.et al (2016).

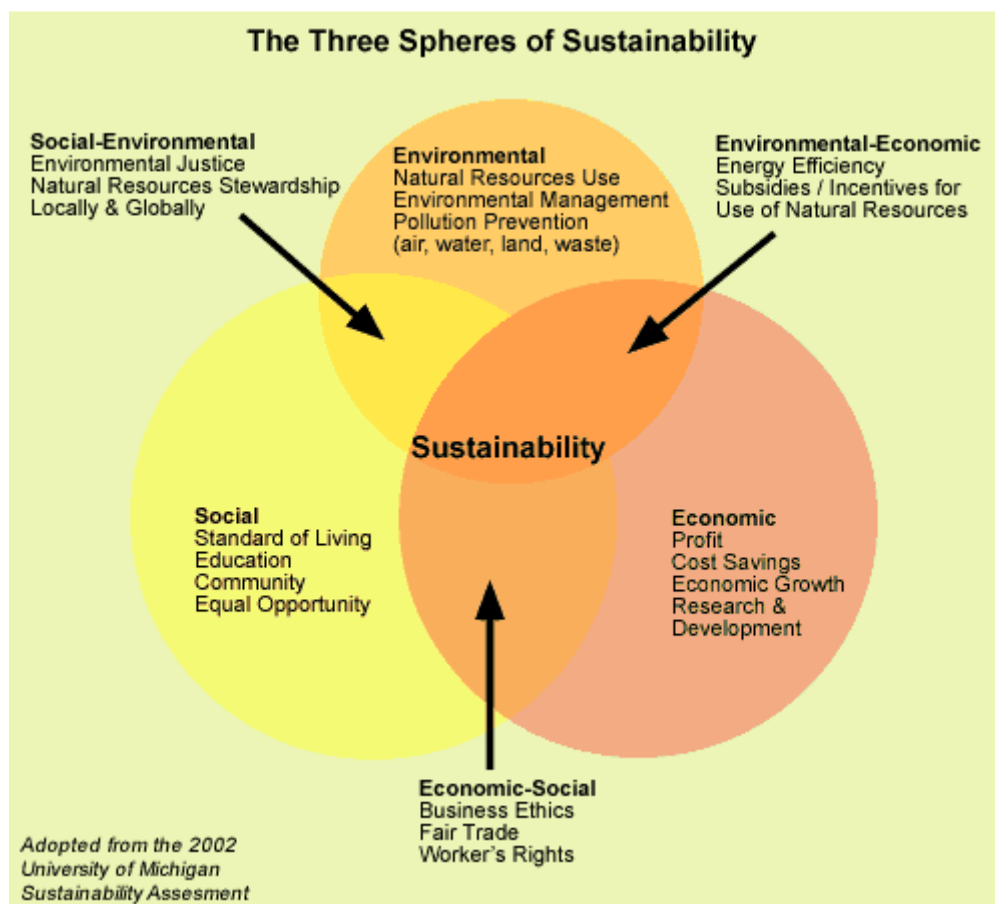


Figure 2.1: Spheres of Sustainability (Adapted: 2002 University of Michigan Sustainability Assessment)

2.4 CHALLENGES OF IMPLEMENTING SUSTAINABLE CONSTRUCTION

If sustainable construction is to be mainstreamed, the challenges that stand in the way must be clarified and prioritized. There are numerous challenges that inhibit successful

implementation of sustainable construction. As with implementation of other methods or approaches aimed at increasing the performance of the construction sector, the application process of sustainable construction principles is sure to encounter various obstacles. Research findings of a study conducted by Osaily (2010) into the key barriers of implementing sustainable construction in Palestine have shown that the application of sustainable construction concept in the industry has faced challenges pertaining to failure to effectively manage markets, finance, employees, prices, and customer satisfaction. Also, management skills such as technical ability and leadership, decision making ability, motivation and aspiration values of managers were all identified as challenges. There is also the challenge of accepting change. Furthermore, financial constraints such as lack of financial resources, limited marketing and human resource management expertise, lack of understanding marketing concept and lack of employees training and development have all been established as obstacles. There is also the challenge of limited strategic planning such as market segmentation, pricing strategies, environmental analysis, and limited incentives for innovation. Ineffective information technology, lack of system knowledge, ignorance of life cycle cost, lack of education and knowledge in sustainable design, and client worries in profitability and pay-back period was also established as barriers (Osaily, 2010). Furthermore, some major challenges associated with the application of sustainable construction involve aspects of awareness, knowledge deficit, lack of legislation and lack of easily accessible guidance (Djokoto et al, 2017).

According to Hakkinen and Belloni (2018), the fear of higher investment costs for sustainable buildings compared with traditional building construction and the risks of unforeseen costs are often addressed as challenges for sustainable buildings. The adoption of sustainable building solutions may be hindered because clients are concerned about the higher risk (Nelms et al., 2005) based on unfamiliar techniques, the lack of previous experience, additional testing and inspection in construction, a lack of manufacturer and supplier support, and a lack of performance information. These costs are also high as according to Bartlet and Howard (2000), cost consultants have overestimated the capital cost and underestimated the potential cost savings. Hydes and Creech (2000) also suggested that these higher costs may be as a result of increases in the consultant's fees and indirectly from the unfamiliarity of the design team and contractors with sustainable building methods. Even though it is a known fact that sustainable practices in construction are estimated to increase initial capital cost generally in the range of 1 – 25%, this can often be offset by significant savings in the

operational costs (Kats and Capital, 2003) and user comfort however these savings are not made known to prospective clients. If, however life-cycle thinking is critically applied to this practice, developers and building owners would appreciate and receive the benefits or those benefits are rapidly discounted. Sustainability would not only reduce life-cycle cost but also increase productivity of staff using the building (Ibid,2014).

Besides, one of the most critical challenges to sustainable construction implementation is the lack of capacity of the construction sector to implement sustainable practices (CIB, 1999). This is further reiterated by Hakkinen and Belloni (2018) that sustainable buildings can be hindered by ignorance or a lack of common understanding about sustainability. Rydin et al. (2006) claim that while designers demonstrate confidence in their ability to access and use knowledge in general, this confidence falls when sustainable building issues are addressed. There are also challenges such as lack of building codes, government policies/support and measurement tools amongst others. On the contrary, a new kind of orchestrating and pioneering role of the building authorities and other public actors in the building sector is called for (Rohracher, 2001).

Largely, any built environment exhibits very strong positive feedback mechanisms so that tendencies towards non-sustainability are very quickly reinforced by other developments triggered by a prior set of changes (Smith et al., 1998). The Zambian Construction Industry is no different. Traditionally, construction professionals are responsible for designing and planning the construction, operation, and maintenance of infrastructure necessary to meet the increasing demand for food, water, sanitation, shelter, health services and economic security (Boswell, 2002). However, the paradigm shift to sustainable development means a redefinition of traditional roles and responsibilities for most professionals. Therefore, professionals face the challenges of acting responsibly, and find the best balance between their technical performance and protecting the overall interests of communities. The feedback on recent developments such as water supply networks, motorways, industrial plants, and general construction has been negative. Reports suggest that the construction sector has a negative contribution to the overall sustainable development (Phiri, 2003).

2.5 BENEFITS OF SUSTAINABLE BUILDING CONSTRUCTION

According to the United States Green Building Council, Leadership in Energy and Environmental Design (USGBC), the advantages of implementing sustainability principles in construction projects are associated with three main aspects (USGBC, 2015):

- Environmental benefits are in the improvement of air and water quality, minimization of energy and water consumption and reduction of waste disposal.
- Economic benefits are reducing operating and maintenance cost and increasing revenue (sale price or rent); and
- Social and community benefits are enhancing occupant comfort and health and minimizing absenteeism, turnover rate, and liabilities (Kats and Capital, 2003).

Moreover, achieving sustainable construction will produce buildings: with lower embodied energy and harmful emissions; using reusable, renewable, recyclable, and repairable resources; and using water and energy more efficiently. It will increase the demand of practitioners (buildings, designers, consultants etc.) and increase marketing and promotional opportunities associated with sustainable building (Manoliadis et al, 2015). Chan and Liu (2013) stated that the adaptation of sustainable construction principles delivers better long-term value to the built environment and its occupants. Manoliadis et al (2015) outlined fifteen drivers for change to implement sustainable construction, which are: energy conservation; waste reduction; indoor environment quality; environmentally-friendly energy technologies; resource conservation; incentive programmes; performance-based on standards; land use regulations and urban planning policies; education and training; re-engineering the design process; sustainable construction materials; new cost metrics based on economic and ecological value systems; new kinds of partnerships and project stakeholders; product innovation and/or certification and recognition of commercial buildings as productivity assets. These benefits should stimulate stakeholders to adopt sustainable construction in their building projects.

2.6 EFFECTS OF UNSUSTAINABLE CONSTRUCTION PRACTICES

Around half of all non-renewable resources mankind consumes are used in construction, making it one of the least sustainable industries in the world (Willmott D 2010). However, mankind has spent most of its existence trying to manipulate the natural environment to better

suit its needs so today our daily lives are carried out in and on constructions of one sort or another: we live in houses, we travel on roads, we work and socialise in buildings of all kinds. Contemporary human civilisation depends on buildings and what they contain for its continued existence, and yet our planet cannot support the current level of resource consumption associated with them. The main impacts of the construction and use of our built environment can be grouped as follows:

2.6.1 ENERGY USE, GLOBAL WARMING AND CLIMATE CHANGE

In the last hundred years the Earth has warmed by about 0.5 Degrees Celsius (Lenzen and Treloar, 2002). There is strong evidence that this is due to an increase in the concentration of certain trace greenhouse gases. Principal amongst these is carbon dioxide which is produced whenever fossil fuels are burnt to obtain energy. Globally, over the past few decades, the main consumers of fossil fuels are the developed countries who enjoy standards of living to which the developing countries aspire. The consequences of the continued growth of energy use are catastrophic. The developed countries must improve their energy efficiency as a part of ensuring that the problem is brought under control. Construction industry related energy use accounts for approximately half of national energy use in the UK. The use of fossil fuel derived energy in the production of materials, during the construction process, and by the occupants or users of the building or structure throughout its lifetime is a source of significant quantities of carbon dioxide. Though not the most potent of the so-called greenhouse gases, it is the one produced in the greatest quantities. These climatic changes themselves may necessitate changes in construction practice.

2.6.2 RESOURCE DEPLETION, WASTE AND RECYCLING

The construction industry is a conspicuous user of resources. Materials are derived from numerous sources and suppliers, and minimisation of waste presents a problem. Although many of the materials in use are common to most sites, the fragmented nature of development constrains the practical extent of recycling. Furthermore, despite the long life of its products, their eventual demolition or redevelopment can produce significant waste for land disposal unless re-used (Willmott, 2010). The mass of resources used in the UK construction industry is dominated by stone and primary aggregates: sand and gravel extraction of these primary resources implies major environmental impact from loss of habitat and ecosystem, damage to the landscape, potential subsidence problems and release of methane. Noise and dust and heavy transport through populated areas confer local nuisance. The same issues arise in the

disposal or processing/recycling of waste. Construction also has a major impact on the environment in its consumption of energy, both directly and embodied in the materials that it uses. The large bulk of materials used, consume a great deal of energy for transport. Taking into account both direct use and embodied energy, the construction industry consumes about 4.5% of UKs total energy, as a consequence of this energy consumption, construction generates over 40 million tonnes of carbon dioxide which contributes to global warming from the greenhouse effect (Lenzen and Treloar, 2002). Acid gases and oxides of nitrogen are also produced, contributing to acid rain and photochemical smog production. The links between water and energy are gradually becoming more evident. Generating energy uses a lot of water for cooling and a lack of water has already led to power cuts where nuclear power stations have been shut down during droughts. Likewise, treating and pumping drinking water and wastewater uses a lot of energy with the UK water industry accounting for around 1% of UK CO₂ emissions (McCormack MS, et al, 2007). Water heating is responsible for 5% of UK CO₂ emissions, and 25% of energy bills (McCormack et al, 2007). The construction industry, using a combination of methods, requires about 6 million litres of water (McCormack MS et al, 2007). Throughout the construction cycle, and especially at the end of a structure's life, large quantities of waste are produced. Significant quantities of waste are also generated by the construction process itself. Much of this wastage is avoidable on site, but lack of attention to design detailing; inappropriate material, dimensions, late variations, over-ordering, etc. also contribute to waste (Lenzen and Treloar, 2002).

2.6.3 POLLUTION AND HAZARDOUS SUBSTANCES IN THE NATURAL AND BUILT ENVIRONMENT

Pollution can be defined in many ways: that arising from the built environment (sewage, waste etc.); pollution caused during the manufacture of materials and products; pollution and hazards from the handling and use of materials or from the site itself; and other construction and operationally related activities. The design and construction phases involve the specification of materials, and the use of plant, processes, and techniques. Most also involve extensive disturbances to the existing environment, whether on green field or previously developed sites. Each of these activities poses a risk of introducing pollutants into the environment which can affect the workers on site, the neighbourhood, or the local ground, water, and air quality. Similar impacts can occur during the operational phase of the development. Such disturbances can also upset the equilibrium between the ground, water and air and introduce the risk of pollution. In the developed world, human beings spend

approximately 90% of their lives within buildings (Clements-Croome D, 2000). They are exposed to a range of chemicals arising from furnishing and finishes. Other practices which take place within the building also affect their physiological and psychological reactions. Increasingly, the design and layout of buildings necessitate active measures to maintain conditions which ensure the health and general well-being of their occupants. The problems of poor internal environment tend to be neglected because the effects are long term and, with a few exceptions, not immediately life threatening.

2.6.4 PLANNING, LAND-USE AND CONSERVATION

There is a wide range of environmental issues concerned with the interaction of the land use, planning system and the construction industry. Almost all development undertaken by the construction industry requires planning permission. The biodiversity on construction sites can be devastated by developments and through mineral extraction for the construction industry. However, a wide range of nature conservation initiatives and area designations have been developed to protect habitats. Construction related activity has a significant impact upon transport movements. Considerable pressure can be placed on the local road network and neighbouring uses by quarrying operations (Kumar R, Kaushik SC, 2019). The interaction between the built environment and the natural environment also has a significant impact on the hydrological system. The combined effect of urban expansion and agricultural intensification has exceeded the capacity of the land to absorb exceptional levels of rainfall. At the same time, rainfall has become more intensive, concentrated, and erratic due to global climate change. This negative interaction is highlighted by an increasing rate of severe flooding witnessed in the UK, Italy, Germany, Cambodia, Vietnam, and India in the period 2000–8 (Kumar R, Kaushik SC, 2019).

2.7 BARRIERS TO IMPLEMENTING SUSTAINABLE BUILDING CONSTRUCTION

There are several potential barriers to the implementation of sustainable construction with the main one being perceived high cost. The common perception about sustainable buildings appears to be that they cost more than ordinary buildings. They increase initial costs by an average of 2 to 7 per cent over ordinary building cost, and only some projects can recoup overall net costs in a short period. Decision makers rarely use whole life cycle costs to estimate reduced operating expenses (Castillo and Chung, 2018). These barriers can be

overcome by moving the thinking of stakeholders from cost to value and from short-term to long-term.

2.8 SIMILAR STUDIES

In a Lebanese case study, Sustainability in the construction industry, research conducted by Majdalani, et al (2019), sustainable construction is a way for the building industry to move towards achieving sustainable development, taking into account environmental, socio-economic and cultural issues. Buildings, infrastructure, and the environment are inextricably linked. Energy, materials, water, and land are all consumed in the construction and operation of buildings and infrastructure. These built structures are also part of our living environment, affecting our living conditions, social well-being, and health. It is therefore important to explore environmentally and economically sound design and development techniques to ensure that buildings and infrastructure are sustainable, healthy, and affordable. The objective of their research was to investigate the role that the construction industry was playing in sustainable development management globally and in Lebanon particularly (Majdalani et al., 2019). Survey questionnaires were distributed to main construction industry players: Contractors, Architects/Engineers, and Owners/Developers. These questionnaires were designed to collect information on companies' environmental awareness and social responsibilities and current practices that include land development, material selections, energy efficiency, construction operations, waste handling, storage facilities, sustainable designs and so on. Results clearly demonstrated widely varying levels of awareness regarding sustainable construction depending more or less on the position and economic interest of each party. Based on the survey, Architects/Engineers were the most aware party regarding sustainability (Ibid, 2019). This may be attributed to the fact that Architects/Engineers are to a large extent legally responsible for designing projects that serve the required intent and society as a whole. Accordingly, Architects/Engineers' design practices ranked highest in terms of environmental concerns and general concerns about sustainable design. On the other hand, research, and development (R&D) initiatives such as energy efficiency and reuse and recycling seemed to be moderately important to Architects/Engineers (Majdalani et al., 2019).

Djokoto et al (2017) in their research, Barriers to Sustainable Construction in the Ghanaian Construction Industry: Consultants Perspectives; The research paper aimed at examining the concept of sustainability in the Ghanaian construction industry with the objective of

identifying possible barriers to sustainable construction in the Ghanaian construction industry. Consequently, research data was collected through a questionnaire survey of randomly selected professionals in the construction industry in Ghana. Data collected was mainly analysed using Relative Importance Index to rank barriers identified. The results showed that key barriers to sustainable construction were lack of demand for sustainable buildings, lack of strategy to promote sustainable construction, higher initial cost, lack of public awareness and lack of government support.

In a study titled *Greening the Construction Industry in Nigeria* by Elizabeth M. et al (2016), aimed at providing insight into the extent to which Nigerian construction has fared in green/sustainable supply chain management as means to ensuring sustainable construction to meet both the immediate and future construction needs (Wu et al., 2019). The study made use of questionnaire divided into sections containing basic information about the respondents and the focus of the research. Out of 28 respondents, 13 being the 44.4% of the respondent agreed that improved sustainability of resources is a major benefit of green/sustainable supply chain management in Nigeria construction industry, 11 respondents being 40.7% agreed is improved quality of products, 8 respondents (28.6%) indicated positive impact on financial performance and reduction in risks as a major benefit, 7 respondents (25.0%) indicated stronger adherence to regulations while 6 respondents (21.4%) indicated increased efficiency as a major benefit of green supply chain management in Nigeria construction industry. From the findings, construction firms in Nigeria were aware of the benefits of green/sustainable supply chain management in construction. Also, they were aware that suppliers need to be environmentally compliance. The study concluded that the problem, Nigerian construction firms are facing are not issue of making law, rather it is implementation problem. Proactive industries usually have greater implementation of environmental practices beyond requirements of laws and regulations, while reactive industries only seek compliance with regulatory requirements. Government, regulatory institutions and like professional bodies must rise up to their duties and ensure implementation of sustainable construction. This study provided a valid reason to green/sustainable construction and ample reason for Nigerian construction industry to adopt GSCM.

Solomon M. et al (2019) in a study titled *Challenges Faced by Practitioners in the Adoption of Green Building Concepts: A Case of Nairobi City County*. The main objective of the study was to investigate the extent to which green building concepts have been adopted within Nairobi commercial buildings, and determine the challenges faced by practitioners and

developers in the adoption of these concepts. The specific objectives included documentation of green building concepts adopted in the commercial buildings and determining appropriate strategies for implementing the concepts. In the study a population size of 152 respondents from 38 sampled buildings was expected (n=152) from Architects (38), Quantity surveyors (38), Property Managers (38), and Engineers (38), respectively. To determine the challenges faced by practitioners in the adoption of green building concepts, respondents were asked to use a 5-point likert scale to determine the extent to which the identified challenges in the literature review hinder increased adoption. A mean score was calculated where a lower mean meant that the factor posed a high challenge whereas a higher mean was interpreted as a less challenge in adopting the concept. The study revealed that lack of enforcement on sustainable building policies posed a greater challenge to adoption of the concept with the lowest mean of 1.81. Lack of awareness had the highest mean of 3.74. The mean of 1.81 on lack of enforcement of sustainable building policies suggests that enforcement is the foremost challenge in adopting the concepts. Studies suggest that it is difficult to enforce sustainable building policies as enforcement requires adequate education and training of professionals and other players in the construction industry. They suggest that improved enforcement can be laid through starting with voluntary schemes and use of incentives to overcome the challenge. The study further concluded that increased enforcement of urban land and planning policy by both the national and the local government can increase levels of adoption of green building concepts coupled, with increased research and good urban planning and land use policies. In order to alter the current scenario, it is recommended that an appropriate legal and institutional framework is developed to provide the necessary leverage required for adoption of green/sustainable concepts in the built environment.

2.9 KNOWLEDGE GAP

Studies have identified and characterised a variety of construction sustainability opportunities with various degrees of success. Unfortunately, the breadth and depth of information in these are inconsistent, and at times fail to recognise factors that influence the implementation of sustainable building construction practices by construction professionals. Valuable in-depth investigations and basic tools/checklists on specific sustainable construction practices are not readily available for practical use. Moreover, guidance regarding the implementation of sustainable building construction solutions has not been developed and is unavailable. Further research is required to determine the most effective practices and associated performance metrics for deploying sustainability-focused initiatives in the design, construction, operation

and decommissioning phases of building projects. If more information and guidance on sustainable practices was available, these practices may be applied more frequently on building construction projects in Zambia.

2.10 SUMMARY OF LITERATURE REVIEWED

Table 2.1. Summary of Literature Reviewed

Author	Year	Title	Objectives	Methodology/ Methods	Conclusions	Comment/ Critique
Majdalani Z., Ajam M., and Mezher T	2019	Sustainability in the construction industry in Lebanon	To investigate the role that the construction industry plays in sustainable development management	Qualitative methodologies, survey questionnaires	Results clearly demonstrated widely varying levels of awareness regarding sustainable construction depending more or less on the position and economic interest of each party. Based on the survey, Architects/Engineers were the most aware party regarding sustainability	Unlike the current study, this research used only qualitative methodologies, so even though the finding were exhaustive, they lack actual statistics hence difficult to know were exactly to start from for intervention purposes.
Djokoto Susan Dzifa, Dadzie John and Ohemeng-Ababio Eric	2016 2017	Barriers to Sustainable Construction in the Ghanaian Construction Industry: Consultants Perspectives	Examining the concept of sustainability in the Ghanaian construction industry with the objective of identifying possible barriers to sustainable construction	Qualitative questionnaire survey of randomly selected professionals	The results showed that key barriers to sustainable construction were lack of demand for sustainable buildings, lack of strategy to promote sustainable construction, higher initial cost, lack of public awareness and lack of government support.	This study had useful information as an additional resource for the current study. It only employed qualitative methodologies that constituted lack of statistical knowledge for inferential purposes.
Elizabeth M. Ojo, Charles Mbohwa, and Esther T. Akinlabi	2016	Greening the construction industry in Nigeria	To contribute significantly to the first wave of empirical investigations related to the impact of green supply chain management in Nigerian construction.	Survey of the construction industry which employed both qualitative and quantitative methodologies.	The research concluded that the problem, Nigerian construction firms are facing are legal, rather it is implementation problem. Proactive industries usually have greater implementation of environmental practices beyond requirements of laws and regulations, while reactive industries only seek compliance with regulatory requirements. Government, regulation	Vital resource for the current study because its methodologies are somewhat similar with those of the current study. Using both methodologies makeup for each other's pitfalls, that make the research iron clad per se.

					bodies like professional body must rise up to their duties and ensure implementation of law.	
Solomon W. Were, Stephen O. Diang'a and Anthony K. Mutai.	2019	Challenges Faced by Practitioners in the Adoption of Green Building Concepts: A Case of Nairobi City County.	To highlights the key challenges faced by practitioners in the adoption of Green building concepts	Qualitative and quantitative by means of questionnaires, interviews, observation and review of available documents, journals and books.	Lack of enforcement of sustainable building policies and incentives from the government were some of the greatest hindrances facing practitioners in the adoption of the concepts.	The study used both methodologies that made it 'iron clad'. It was used to for comparison purposes with the current study which made it vital to the study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter provides a systematic description of the research methodology that was used to answer research questions. The chapter specifically dealt with research design, research site, and target population, sampling design, data collection methods and analysis procedures.

3.2 RESEARCH DESIGN

This study was conducted through a survey research design and made use of both qualitative and quantitative modes of inquiries to investigate sustainable building construction practices in Zambia. According to Burns (2000), a combination of qualitative and quantitative methods is advantageous because they supplement each other. Quantitative methods provide hard data whereas qualitative methods provide in depth explanations therefore the findings derived from one method validates the other.

The focus was on the professional in the construction within Zambia's Lusaka and Copperbelt areas with high concentration of new buildings projects as relates to the scope of this study. Lusaka and Copperbelt area had experienced a rise in the number of commercial buildings in the last five years (NCC, 2018b). The primary data was obtained through observations, interview schedules and by administering questionnaires to individuals who were behind the design, construction, and management of the buildings. For quantitative method, parameters that define sustainable/green construction with a range of variables from minimal to complete incorporation of the elements determined the degree of adoption. The degree of adoption was statistically analysed on the sampled individuals. These individuals being in the same geographical area and near similarity in projects undertaken and experience minimised sampling error.

3.3 SOURCES OF DATA

Both primary and secondary data were sourced from the field using semi structured interviews and structured questionnaires (see appendix 'A' and 'B' for Questionnaire and Interview guide). The primary data emanated from questionnaires directed to Architects, Engineers, Quantity Surveyors and Property Managers. Further primary data were obtained from semi structured interviews with policy makers in addition to observations made during

inspections. Secondary data was collected through review of past work, journal articles, textbooks and from the internet.

3.4 POPULATION AND SAMPLE

3.4.1 Population

Population in this study consisted of professionals in the construction industry involved in commercial building projects. A total of fifty (50) professionals were identified for this study in Lusaka and Copperbelt Towns (Ndola and Kitwe) as indicated earlier on. The choice of this geographical area for the research was informed by the fact that major commercial building projects have been constructed in these locations between the periods of the study. To maintain uniformity, professionals involved on projects of at least two floors and above were interviewed. This ensured that the composition of the accessible population had the same characteristics hence homogeneous.

3.4.2 Sample and Sampling procedure

Due to time and resource constraints, the study was restricted to a portion of the target population. It focused on 75% of the target population; Burns (2000) recommend a minimum sample of 30 items. The research used a purposive and convenience sampling technique in selecting the sample frame. This method was adopted because the researcher deliberately wanted to elicit the views and opinion of key individuals and stakeholders in the construction industry. It targeted architects, engineers, quantity surveyors and property managers from Government and Private Organisations based on their work experience and academic qualification (diploma and above). Lusaka, Ndola, and Kitwe cities were selected based on their proximity and high amount of construction activity. A total of 45 questionnaires and five (05) interviews were administered. The questionnaires were self-administered. Out of the fifty (50) questionnaires, thirty (35) were returned and five interviews were conducted representing 80% response rate. The data received from returned questionnaires were analysed using tables categorized into responses, frequency, and percentages. Pie charts were also used in some situations.

3.5 DATA COLLECTION INSTRUMENTS

In this study, structured questionnaires, semi structured interview schedule and inspections were used as the instruments for data collection.

3.5.1 STRUCTURED QUESTIONNAIRE

Questionnaires designed with closed and open-ended questions were directed to different respondents which included Architects, Engineers, Quantity Surveyors and Property Managers.

3.5.2 SEMI - STRUCTURED INTERVIEW SCHEDULE

Enquiries were made from policy makers in the building industry particularly from the technical departments of the Government Republic of Zambia: Ministry of Housing and Infrastructure Development, Ministry of Local Government, and Ministry of Works and Supply through direct or personal contact. These interviews were open ended and directed mainly to the experts at the level of Assistant Director and above.

3.6 DATA COLLECTION PROCEDURE

The questionnaires were pretested on samples that were similar to the actual samples intended for the study and the procedure for pretesting were identical to those that were used during the data collection. This enhanced the reliability of the instrument as questionnaires were adjusted before the final edition was released.

3.7 DATA ANALYSIS METHODS

Data from questionnaires, observation checklist and interview schedules were coded to assist in analysis. Responses from closed ended questions were assigned numerical values and analysed quantitatively using mean item score and percentages whereas the open-ended questions were analysed qualitatively by examination and interpretation of patterns and themes.

For closed ended questions, the analysis involved the use of mean item score, frequency count and ranking generated through use of statistical program for social sciences (SPSS) version 20 to generate tables and pie charts. Microsoft office excel was also used to generate other charts and graphs for discussion.

3.8 RELATIVE IMPORTANCE INDEX (RII)

The research made use of relative importance index (RII) method to determine the relative importance of each of the challenges and concerns identified. The five-point scale range from 1(strongly disagree) to 5(strongly agree) was adopted and transformed into relative importance index and ranked for each as follows:

Relative Importance Index (RII)= $\Sigma W/A \times N$

Where:

- W= Weight given to each factor by respondents ranging from 1 to 5
- A= Highest weight (i.e., 5 in this case)
- N= Total number of respondents

The RII value had a range from 0 to 1 (0 not inclusive) the higher the value of RII the more important or frequent was the challenge or concern in promoting sustainable building construction.

3.9 DATA VALIDITY, RELIABILITY AND REPLICABILITY

Various procedures were used to collect the data. The main instruments used in the study consisted of closed-ended, open-ended questionnaires, interviews, and observations. These different ways of gathering information supplemented each other and hence boosted the validity and dependability of the data. In the Report, the quantitative data were obtained through closed-ended questionnaires and the qualitative data through open-ended questionnaires, interviews, and observations. The items of the questionnaires were mainly developed based on the research objectives and research questions.

The data was then triangulated, and member checked. Triangulation was possible because various techniques were used to collect the information and through corroboration of the findings giving the same results was confirmation that the results were valid. The results and interpretations were taken back to the participants to be confirmed and validated – member checked. In this way the plausibility and truthfulness of the information was recognized and supported.

3.10 ETHICAL CONSIDERATION

This study was approved and undertaken with the full consent of the university's board of post graduate studies as shown in appendix C. The participant's consent was sought through a cover letter that explained the aim of the study. They were also assured that the information provided was purely for academic purposes only. The respondents were encouraged to participate voluntarily and were assured that the observations were only going to be used for the study.

3.11 SUMMARY

The Study made use of both the quantitative and qualitative data collection techniques. This allowed for a rich wide range of data to be collected. The sample size for the study was fifty (50) professionals involved in construction of buildings in Lusaka and Copperbelt Towns of Zambia. Questionnaires, interviews, and observations were used to collect data. The collected data was triangulated and analysed using SPSS version 20. Chapter Four (4) presents an analysis of the data in line with the objectives of the study.

CHAPTER 4: DATA PRESENTATION AND ANALYSIS

4.1 INTRODUCTION

This chapter presents and analyses data from the research which sought to make recommendations for promoting sustainable building construction practices and principles to enable key stakeholders put into action the consideration of sustainability in building construction projects in Zambia. The analysis of data is presented in line with the objectives of the study. However, the first section looks at the background of the respondents from whom data for the study was collected.

4.2 TABULATION OF CONTEXTUAL DATA

Data for this study was collected from thirty-five (35) respondents of whom 10 were Civil/Structural Engineers, Quantity Surveyors, 8 were Architects, 6 Construction Managers, and 1 was a Land Economist. The distribution of role of the respondents 'organization in construction included 40 percent Client/ Client Representative, 28.6 percent contractors, 22.9 percent Consultancy, 5.7 percent Property Development, and 2.8 percent Academia. The bulk of the respondents had 5 to 10 years of experience, representing 54.2 percent of the sample. The proportion of respondents with more than 10 years of experience was reasonably high at 37.2 percent. Table 4.1 shows the contextual data of the study sample.

Table 4.1: Tabulation of Contextual Sample Data

		Frequency	Percentage
Professional Background	Architect	08	22.86
	Construction Manager	07	20
	Civil/Structural Engineer	10	28.57
	Quantity Surveyor	07	20
	Property Manager	03	8.57
	Total	35	100
Organizational Role	Contractor	10	28.57
	Consultancy	08	22.86
	Client/ Client Representative	04	11.43
	Regulatory Body	04	11.43
	Property Developer	06	17.14
	Academic/Lecturer	03	8.57
	Total	35	100
Work Experience	Less than 5 years	3	8.57
	5 to 10 years	17	48.57
	10 to 15 years	5	14.29
	15 to 20 years	8	22.86
	More than 20 years	2	5.71
	Total	35	100

4.3 AWARENESS ON SUSTAINABLE BUILDING CONSTRUCTION

The study revealed that respondents were aware of sustainable building construction. All the respondents affirmed awareness to sustainable construction. When asked further about their understanding of sustainable construction, respondents answered in varied ways. There was, however, a general principle that permeated all the definitions. The three sustainability themes of economic, social, and environmental stewardship were present in all definitions. All respondents exhibited a good understanding of sustainable construction. The level of awareness among respondents was good. Respondents had acquired knowledge through School, Books/Magazine, Colleagues, and the Internet.

From Figure 4.1 below, a probe to check the level of awareness in sustainable construction revealed that 86% of respondents had a good level of awareness with 14% being excellent.

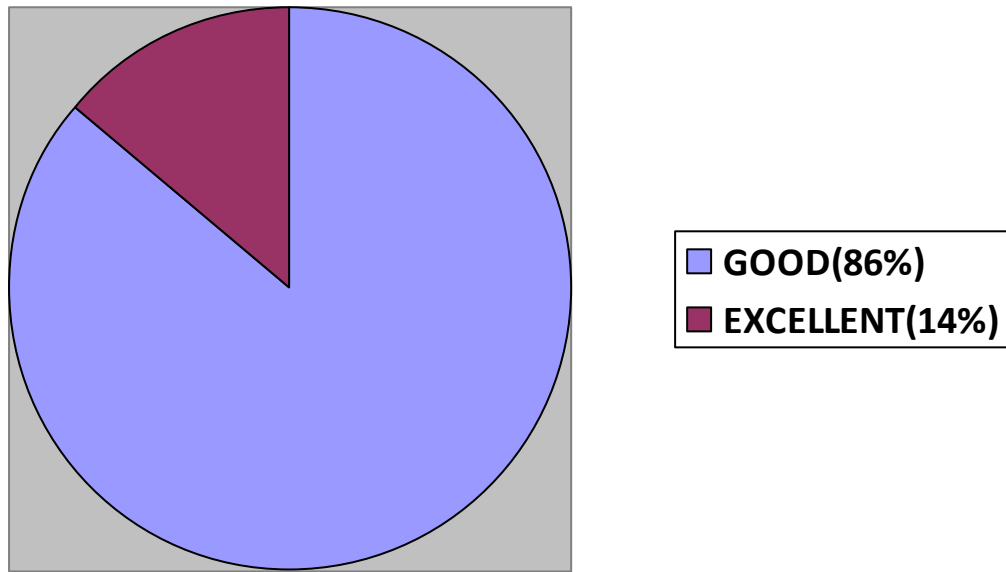


Figure 4.1 Level of Awareness

4.4 KNOWLEDGE OF SUSTIANABLE CONSTRUCTION

Respondents disagreed that there was widespread knowledge of sustainable construction. None of the respondents agreed to the statement that there is widespread knowledge of sustainable construction in Zambia. Knowledge among construction officials is good but not across other departments which are not directly involved with construction decisions.

4.5 SUSTAINABLE CONSTRUCTION ISSUES CONSIDERED MOST

Table 4-2 of the results is divided in two parts, for the first part, the respondents were asked what aspects of sustainable building construction their organizations/companies considered and shows issues of energy wastage, deforestation, and economic development of the society in their operations. However, economic development of the society was considered highest 37%, followed by energy wastage 30% and deforestation 33%.

**Table 4.2: Sustainable Construction issues considered by
Organizations and Experts**

	FREQUENCY	PERCENT
Energy wastage	20	29.85
Deforestation	22	32.84
Economic development of society	25	37.31
TOTAL	67	100.0
ISSUES CONSIDERED BY EXPERTS		
Economic	10	25.64
Social	9	23.08
Environmental	20	51.28
TOTAL	39	100

Based on the second part of Table 4.2 above, environmental sustainability issues were given more prominence by respondents than the others with 51.3% considerations – which is the ideal situation for the promotion of sustainable construction. Other issues like economic came second with 25.6% while social issues were considered the least with 23.1%.

4.6 TABULATION OF PRIMARY SUSTAINABLE CONSTRUCTION CONCERNS IN CONNECTION WITH OPERATIONS.

Table 4.2: Sustainable Construction in connection with Operations.

	RESPONSES					RII		
	1	2	3	4	5	Weight	RII	Rank
Disposal of waste or by products	0	5	3	18	9	136	0.777	1st
How to save power or electricity	0	10	1	15	9	128	0.731	2nd
How to conserve water	0	8	15	8	8	119	0.680	4th
Safety at workplace	0	6	9	15	5	124	0.708	3rd
How to stimulate local economy	0	0	24	10	1	117	0.668	5th
How to conserve wildlife	0	1	27	7	4	116	0.663	6th

Rank: [5-Strongly agree, 4-Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree]

This section assessed the primary issues which were considered by construction professionals in connection with their operations. It sought the agreement or disagreement of respondents to some key considerations in sustainable construction and considered which of the measures were considered most. Disposal of waste appeared to be the key issue considered most with a relative importance index (RII) of (0.779). The least considered issue was conservation of

wildlife with a relative importance index (RII) of (0.672). Furthermore, socio-economic issues had a low relative importance index (RII) of (0.677) in 5th place.

4.7 CHALLENGES AFFECTING SUSTAINABLE CONSTRUCTION IN ZAMBIA

This section sought to measure the extent of agreement by respondents to the challenges of sustainable construction in the literature review. It aimed at establishing whether the construction industry professionals could identify with those challenges. Respondents identified with the following challenges (1) lack of public awareness, (2) lack of interest in the issue of sustainability, (3) poverty and perceived high cost of initial investment, (4) lack of research into sustainable construction, (5) lack of capacity of the construction sector, (6) little incentive for professional officers, (7) resistance to technology, (8) turbulent economic environment, and (9) lack of accurate data.

Table 4.3: Challenges affecting Sustainable construction in Zambia

	RESPONSES					RELATIVE IMPORTANCE INDEX (RII)		
	1	2	3	4	5	WEIGHT	RII	RANK
Lack of public awareness	0	0	0	26	9	149	0.851	1 st
Lack of interest in the issues of sustainability	0	0	12	6	17	145	0.828	2 nd
Poverty and perceived high cost of initial investment	0	1	12	13	9	135	0.771	3 rd
Lack of research into sustainable construction	0	1	14	12	8	132	0.754	4 th
Lack of capacity of the construction sector	0	3	14	12	7	131	0.748	5 th
Little incentive for professional officers	0	5	20	10	0	110	0.628	6 th
Resistance to technology	0	12	17	6	0	99	0.566	7 th
Turbulent economic environment	0	15	16	4	0	94	0.537	8 th
Lack of accurate data	0	17	15	3	0	91	0.520	9 th

Rank: [5-Strongly agree, 4-Agree, 3-neutral, 2-Disagree, 1-Strongly Disagree]

According to the ranking in table 4.3, the top three challenges of sustainable construction are Lack of public awareness, lack of interest in sustainability issues with poverty and perceived high cost of initial investment. Lack of public awareness was ranked highest and was identified by respondents as the major challenge in promoting sustainable construction. It was ranked 1st among the other challenges. They least identified with lack of accurate data as a challenge.

4.8 MEASURES UNDERTAKEN TO MITIGATE CHALLENGES

Table 4.4: Measures against challenges

MEASURES	FREQUENCY	PERCENT
Education to adopt to situation	31	88.57
Vegetation reforestation	4	11.43
TOTAL	35	100

Two key issues were dominant as measures taken by construction officials to mitigate the challenges of sustainable construction. These issues were education to adapt to situation and vegetation restoration. According to table 4.5 most respondents undertook education to adapt to situation with 86.7% as a way of mitigating the challenges of sustainable construction, while Vegetation reforestation was also used with (13.3%). In other words, stakeholder sensitization was done mostly along with vegetation reclamation. This is to promote public support, understanding and interest.

4.9 SUMMARY

According to the results of the study most of the respondents had knowledge about sustainable building construction practices. There was, however, a general agreement that the three (3) sustainability themes of economic, social, and environmental are paramount, with economic development of the society considered highest at 37% by non construction industry experts and environmental sustainability at 51.28% by construction industry experts. Lack of public awareness, lack of interest in sustainability issues with poverty and perceived high cost of initial investment were indicated as major challenge in promoting sustainable construction. Education, public sensitisation, and vegetation restoration were the main mitigation measures that could be put in place to reverse the effect of unsustainable building practices. These findings are further discussed in Chapter five (5) to examine the current construction (building) practices, to explore the fundamental principles of sustainable construction practices and challenges in the implementation of sustainable building construction practices in Zambia.

CHAPTER 5: DISCUSSION OF FINDINGS

This chapter discusses the findings of the research. It answers the following objectives: to examine the current construction (building) practices in Zambia; to explore the fundamental principles of sustainable construction practices; and to identify the main challenges in implementing sustainable building construction practices in the Zambian Construction Industry.

5.1 THE CURRENT CONSTRUCTION (BUILDING) PRACTICES IN ZAMBIA

The building and construction sector is of key importance to the development of Zambia and the well-being of its population. Zambia can fulfil the demand for a built environment that meets the needs of the Zambian people through the application of sustainable building and construction (SBC) concepts. The results of this study indicate that, 86% of the respondents have a good level of awareness on sustainable construction. The level of knowledge on sustainable construction is high based on the findings in table 4.1. This therefore gives a solid ground preparation for measures to improve on sustainable construction. The aim of achieving a sustainably built environment calls for excellency to which, according to the findings on awareness only 14% meet that threshold. This means that, Officials dealing with construction have appreciable knowledge on sustainable construction but there is the need to do more for the translation of this knowledge into tangible sustainably constructed buildings. The results further indicate that, there is no widespread knowledge of sustainable construction in Zambia. Knowledge among construction industry professionals is good but not across other departments which are not directly involved with construction projects.

Construction companies attach a higher value on the economic gain that the building will have to society and neglect to consider if the needs of the present would not be compromising the ability of future generations to meet their own needs. From the results, 37% of construction organizations/companies considered economic development of the society as a priority when it came to sustainable construction matters. This was followed by deforestation 33%, and energy wastage 30%. This is true to the general belief that developing countries – Zambia inclusive – concentrate less on environmental sustainability issues but more on economic and social factors (Ojo et al., 2019). The construction industry is vital for the economic development of any society or nation (African Economic Outlook country note on Zambia, 2014). This according to sustainable construction does not mean, the construction

industry most prioritize economic gains at the expense of the environment which is the bedrock of sustainability. The results indicated that 51.3% suggested environmental sustainability issues to be given more prominence when it came to sustainable construction.

The study further investigated the primary issues that were considered by the professionals in the construction industry in the study area in connection with their operations in order to have a full depiction of the current situation of sustainable building construction. From the results, the disposal of waste with a relative importance of 0.779 was considered as the most practised in sustainable construction while the least was conservation of wildlife having a relative importance index of 0.672. This is a depiction that sustainable commercial building construction in the study area is above relative importance index of above 0.5 but way less than 0.85 which is not good but not very poor/ bad at the same time. This is a clear indication of the potential and progression of the Zambian construction industry to fully embrace sustainable building construction practices.

5.2 THE FUNDAMENTAL PRINCIPLES OF SUSTAINABLE CONSTRUCTION PRACTICES

Sustainable development is the basis for enhancing the understanding of the principles of sustainable construction, which emerged as a new pattern to create a favourable built environment that meets human's present needs without jeopardizing the ability of the future generation to meet theirs. In principle, sustainable construction essentially covers the triple bottom line of environmental, social and economic attributes that are exemplified in the sustainable development mantra. Several factors have been identified that could contribute to construction organisation's adoption of sustainable construction. However, the implication for firms' innovative techniques as the drivers for sustainable construction is clear. The construction industry's contribution to ecosystem degradation, climate change, and several interdependent issues call for innovative construction technologies, products, business, processes, and marketing approaches to address the underlying ecological loads of construction projects.

Many empirical studies (Majdalani, et al., 2019; Chan and Liu, 2012; Djokoto et al., 2016, 2017) that examined the factors influencing the achievement of sustainable construction have affirmed the importance of innovative construction as a unique way of achieving sustainable construction, albeit in a conflicting way. Obviously, sustainable construction requires fresh knowledge and learning within the construction industry, because professional innovativeness

not only improves client's satisfaction, competitive advantage, and profitability, but also a vital procedure in sustainability adoption in an organization. Again, earlier studies have also shown that organisational culture not only influences operations within a firm, but it also plays an essential role in the efficiency and improved productivity of an organisation, proven to be important initiatives in achieving construction sustainability among construction firms.

Thus, government support is considered as a potential moderator on the relationship between organisational innovativeness, organisational culture, and sustainable construction, due to its observed and noticeable influence on the processes and outcomes of both new and ongoing construction projects. Again, this perceived relationship (between organisational innovativeness, culture and sustainable construction moderated by government support) has not been given a considerable attention within the Zambian Construction Industry. Players in the construction industry should change their technologies and better understand the fundamentals of sustainable building construction. Furthermore, construction organisations should choose from a range of innovations in addressing sustainability issues in the construction as the development of a sustainable or green technology strategy involves a strong innovation focus. The construction industry needs to develop cultures that promote, support, and compensate sustainability adoption. In so doing, culture should be prioritized and placed at the centre of development strategies due to its significant role in framing people's relationship and attitudes towards the built and the natural environments.

Consideration of primary sustainable construction principles would in a long term bring some benefit to society. Proper disposal of waste would help solve sanitation problems in the country, Power saving considerations would help reduce electricity consumption and reduce the burden on electricity generation in the country, safety at workplace would ensure human security and reduce accidents on site while stimulating the local economy would generate employment and create wealth. Conserving wildlife would also help improve the ecosystem and reduce the impact of construction on other life forms. These principles form the basis for any strategy to promote sustainable construction such as the use of biogas and water improvement systems. All these come under the ambit of the primary sustainability themes of social, economic, and environmental stewardship.

5.3 MAIN CHALLENGES IN IMPLEMENTING SUSTAINABLE CONSTRUCTION PRACTICES IN THE ZAMBIAN CONSTRUCTION INDUSTRY

The construction industry is complex in nature because it comprises large numbers of parties as owners (clients), contractors, consultants, stakeholders, and regulators. Despite this complexity, the industry plays a major role in the development and achievement of society's goals. According to the results, lack of public awareness with a relative importance index of 0.836 was ranked highest and was identified by respondents as the major challenge in promoting sustainable construction. This was followed by a relative importance index of 0.815 for lack of interest in the issue of sustainability by all parties involved. The third challenge is poverty and perceived high cost of the initial investment for constructing a sustainable building, having a relative importance index of 0.810. These three mentioned challenges have a significantly high relative importance index and are the top impediments to sustainable building construction in Zambia. From the results the other major challenges of sustainable construction are: lack of research into sustainable construction; lack of capacity of the construction sector; little incentive for professional officers; resistance to technology; turbulent economic environment; and lack of accurate data.

The study further investigated what has been done to eradicate the above challenges and the first thing that the professionals in the construction industry – 87% of them – did was to get an education on sustainable construction for them to easily adapt to the 'new norm' of green construction. The statement, education on sustainable construction complements a number of fields such as environmental education, multicultural education, conservation education, global change education, ecological literacy education, as well as sustainable engineering in broad terms. This is a process that develops apprentice (student/learner) awareness, competence, attitudes, and values, enabling them to be effectively involved in sustainable development at local, national, and international levels, helping them to work towards a more equitable and sustainable future. In particular, it enables apprentices to integrate environmental considerations into economic decision-making. For example, when one understands that buildings, not automobiles, emit most of the carbon dioxide (CO₂) in the United States and that the average house is 45% bigger now than it was 31 years ago (Mbachu and Nkando, 2011), they can begin to understand the role they play in environmental sustainability. In order to make such information accessible and relevant to students, it is imperative that academics in engineering, construction, education, and other disciplines heed the call for sustainable technologies, policies, and practices.

5.4 SUMMARY

The building and construction sector plays a key role to the development of Zambia and through the application of sustainable building and construction (SBC) concepts, the country can fulfil the demand for a built environment that meets the needs of the Zambian people. This requires that all players in the construction sector have knowledge on sustainable construction. However, knowledge among construction industry professionals is good but not among other players who are not directly involved with construction projects. Therefore, government support is considered as a potential moderator on the relationship between organisational innovativeness, organisational culture, and sustainable construction, due to its observed and noticeable influence on the processes and outcomes of both new and ongoing construction projects. There is need for players in the construction industry to change their technologies and better understand the fundamentals of sustainable building construction. The construction industry needs to develop cultures that promote, support, and compensate sustainability adoption by prioritising strategies that promote sustainable building practices. The need for research into sustainable construction; capacity building of the construction sector; incentives for professionals to practice sustainable construction and accept or adapt new technologies should be encouraged. Chapter six (6) summarises the major findings of the research. The chapter draws a conclusion and makes recommendations for implementation of sustainable building construction in Zambia.

CHAPTER 6: SUMMARY, CONCLUSION AND RECOMMENDATIONS

This research was aimed at investigating sustainable building construction practices in Zambia so as to make recommendations for strategies to enable key stakeholders put into action sustainability principles in the implementation of sustainable building construction projects in Zambia. It identifies the challenges to sustainable construction practice and developed a strategy to improve sustainability in the way companies initiate and deliver projects.

This chapter draws together the major findings of the thesis and present the contributions of this study. It provides an understanding of the complexities associated with sustainability and construction in Zambia providing the implications of the findings on policy and identifies opportunity for sustainable practices. Based on that, draw a conclusion, provide recommendations for implementation, and offer future possibilities.

6.1 SUMMARY

6.1.1 MAJOR FINDINGS OF THE STUDY

Construction activities in Zambia are based on long established traditional practices that are fundamentally unsustainable. The huge number of on-going building and infrastructure development projects and overall development-need presents opportunity to follow a sustainable developmental path. But the systems and structure of activities in the construction industry such as the contract administration practice, government policies and regulatory framework and the construction business environment do not clearly support sustainability (see section 4.3, 4.4, 4.5, and 5.1). The outcome of this situation is low uptake of sustainable practices, which leads to an overall increase in environmental and social damage. However, it is necessary for construction companies and other stakeholders in the industry to operate in such a manner that will minimize, or as much as possible, eliminate the possibility of further socio-environmental damage.

Considering the complexities of sustainability and construction in Zambia, it is not a situation where there are immediate cause-and-effect solutions to modifying construction operations to enhance sustainable practices, but rather a systemic solution is required, and there is need to

move the entire system. This study identifies the various leverage points where to start moving the system. It utilizes a dynamic multi-level system approach for sustainability transition, to show how construction practices in Zambia can migrate from the current traditional practices to a more socio-environmental path that is sustainable by delivering outcomes that benefit society – whether that be social, economic, or environmental.

The findings of this thesis indicate that the construction industry faces several challenges such as the level of awareness and understanding of sustainable construction, perception of construction delivery, stakeholders' commitment to sustainability and values, capacity to deal with sustainable construction issues, and difficulties of developing and implementing regulations that support sustainable construction. Sustainability is not explicitly embedded into the value system of the local construction practices. This is evidenced in the general lack of commitment and political will to implement and enforce socio-environmental values in the operations and governance of construction activities in the industry (See 4.3 and figure 4.1). The government (which is also the main player in the industry) does not expressly demand sustainable practices, and with the absence and/or ineffective enforcement of sustainability policies and legislation, companies and actors in the industry show apathy towards sustainable building construction in project delivery. Together with this, the challenges of corruption, insecurity, improper coordination of construction activities, cost-benefit uncertainty, inadequate training, skills, and funding to support sustainable construction present additional layer of difficulties. Consequently, there is a general low interest towards uptake of sustainable construction in Zambia.

The additional contribution of this research shows how change from the traditional practices to sustainable construction can be achieved both at the macro level (construction industry as a whole) and at the micro level (company level) (see 2.3 and figure 2.1). The construction companies can become more encouraged to embrace the socio-environmental opportunity inherent in current quality management processes if they can perceive that environmental values and practices have the potential for the achievement of the conventional economic benefits. The research indicates that the transition from a traditional to socio-environmental forms of construction practices does not so much require wholesale change, but rather a modification of how conventionally construction practices are viewed by companies and professional delivery construction projects.

Beyond changing stakeholders' values and perception of construction, this study acknowledges that understanding of the psychology of decision making is only a part of the change process as this will involve broader social, economic, and regulatory forces that influence construction practices. As there are multiple aspects involved that need to co-occur, requiring change through top bottom and bottom-up pathways. This study suggests that change in perception is needed as a baseline intervention to initiate change that will trigger other changes. In view of the importance of sustainable construction and the potential mechanism for intervening, there is need for governance, legislation, and policy modifications. The people that are going to help achieve these goals in Zambia are the construction professionals, thus change in perception of these professional will enhance the application and implementation of other interventions.

The contributions of this research may well provide positive impact on the actions of actors in the industry; it will enhance understanding of sustainable development by providing a knowledge foundation for sustainable practices and facilitate the creation of new opportunity for the development of sustainability in the construction industry. This could inform future policy development and practice-based intervention that addresses the particular circumstance with sustainability and construction in Zambia. The information and contribution from this research could help in development of issues relating to knowledge and implementation of sustainable practices, this could stimulate debates amongst practitioners and shape wider discourse in the field of sustainability and construction in Zambia. By providing evidenced based-research and identifying the step needed to improve sustainable construction practices in the industry; it will help to advance the quality of decision making for legislative and regulatory intervention in Zambia.

6.1.2 LIMITATIONS OF THE STUDY

As with most research, there are limitations to the findings from this study. First, there are limitations that are associated with the ability to generalize the outcome of this research. In conducting this study, the research was not just about objectively describing the present reality, neither was it about the subjective interpretation of the perceptions of different participants. Rather, it was about understanding the causes of the present situation and identifying how to improve them. So, the emphasis is not on generalizability of the findings; but, to understand the causal factors, identify opportunity for change and develop a strategy to improve the present practices. By understanding the causal factors for the actions or

inaction of actors in the industry and the context within which these actions occur, it was possible to identify how to improve the situation. However, the limitation necessitates caution to be exercised in the interpretation and generalization of the findings. Although knowledge from this research can be generalized to situations with similar sustainability barriers, particularly Zambia.

Arguably, results based on study of the practices of 35 professionals may not provide a fair representation of the overall population of individuals and companies operating in the construction industry. The focus was deliberate because it was anticipated that investigation of practices of people with the knowledge or familiarity with the concept of sustainable construction will add another layer of complexity to this research. The present research did not seek to evaluate and interpret construction practices, but rather to gain broad insight into the current situation with regards to sustainability and construction practices in the industry and from this develop a strategy for improvement. As mentioned in section 3.4, an important criterion for the selection of case study was the ability of the participants to provide informed answers to the research questions which explore the wider issues of sustainable construction. This suggests more work is required to investigate other individuals working in the industry, specifically those with no adequate training for representation of the overall population to gain in-depth insight into the practices of construction in Zambia.

6.2 CONCLUSION

From the above summary, the conclusion of the study is that. Construction professionals make decisions that often have a critical impact on the environment and society. This enhanced ability to impact others makes sensitivity to ethical and social concerns a must in the construction engineering profession. Obviously, sustainable construction requires fresh knowledge and learning within the construction industry, because firm's innovativeness not only improves client's satisfaction, competitive advantage, and profitability, but is also a vital procedure in sustainability adoption in an organization. The results of the study indicate that, there is a good level of awareness on sustainable construction but does not meet the excellency threshold which sustainable construction needs in order to thrive in the society. Economic development is prioritized over the environment and social aspects of sustainable construction when organizations implement construction projects. The professionals in the industry feel environmental aspects should be given priority when implementing construction projects if there is to be sustainable construction. Lack of awareness by the public on all

matters to do with sustainable construction is the number one challenge in the implementation of thereof. The other challenge is lack of interest from all parties involved to make green construction a fully realized reality. There is potential and progression of the Zambian construction industry to go green.

6.3 RECOMMENDATIONS FOR IMPLEMENTATION

The following are recommendations for future planning and implementation:

- Ensuring that all construction work has a sustainable construction action plan with well-defined targets and strategies such as reducing waste, carbon emissions, energy, and water consumption, delivering social benefits through procurement should be put in place. This action plan will include various strategies and measures such as using sustainable materials, energy efficient technology, use of raw materials like timber from sustainable sources and the use of labor-based construction techniques which will create employment. This will encourage participation of local enterprises and achieve economic and social objectives of sustainable construction.
- There should also be an intensification of education to the general public and professionals in the construction industry by the National Construction Council, Universities and Colleges on sustainable construction practices. The general population should be sensitized on the opportunities and benefits derived from sustainable construction methods. This will increase their interest on sustainability issues and will result in providing support for public institutions in their construction activities and demand for accountability. This is a sure way to improve sustainable construction in public works. Government, the private sector industries, and academia should invest in sustainable construction machinery, equipment, training, and research. This will improve the knowledge on sustainable construction materials, technology, and methods as a measure to improve sustainable building construction.
- There should be well written government policies and guidelines that promote sustainable building construction practices, Government through Ministry of Housing and Infrastructure Development, Ministry of Local Government, Ministry of Lands, statutory bodies like NCC and ZEMA and professional bodies (ACEZ, EIZ, SIZ, ZIA and ZIP) should put in place specific policies and guidelines for promotion and implementation of sustainable building construction. Such policies would compel construction professionals and stake holders to be more proactive with sustainable

construction issues. The law would streamline construction procedures from conception through design implementation, use up to decommission. A clear policy on sustainable construction would establish expectations in the building construction life cycle supported by processes which would identify means and measures of achieving such goals. For smooth implementation of sustainable construction, policies and processes should balance the implementation of the three (03) aspects of environmental, social, and economic to achieve sustainability in building construction projects.

6.4 RECOMMENDATIONS FOR FURTHER RESEARCH

- Further research should be conducted on the extent of Zambia Construction Industry readiness for implementation of sustainable building construction in Zambia.
- Research should be conducted on the use of local building technologies and materials to implement sustainable building construction in Zambia.

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APPENDICES

APPENDIX A: COVER LETTER FOR THE QUESTIONNAIRE



THE UNIVERSITY OF ZAMBIA

School of Engineering

Department of Civil and Environmental Engineering

P.O Box 32379, Lusaka.

Cell: +260 977 268 126, Email: quangomez@gmail.com

Dear Respondent

QUESTIONNAIRE SURVEY ON AN INVESTIGATION OF SUSTAINABLE BUILDING CONSTRUCTION PRACTICES IN ZAMBIA

I am currently pursuing a Master of Engineering Degree in Construction Management at the University of Zambia undertaking a study titled “**An investigation of Sustainable Building Construction Practices in Zambia**”. The study endeavours to explore sustainable building construction practices and the barriers to its implementation. The information obtained will be used to make recommendations for strategies to enable key stakeholders put into action the consideration of sustainability in building construction projects in Zambia Building Construction Industry.

Attached is a questionnaire and based on your experience in sustainable building construction practices and the field of construction, kindly take part in this survey by completing the attached questionnaire. Please answer all questions where possible. All the information given will be treated as confidential and will be used only for the purpose of research.

Should there be any need for clarifications, please feel free to get in touch with the undersigned using the email address and mobile number provided.

Your assistance and time is highly appreciated.

Yours Faithfully,

Gomezga Gregory Mtonga (Master of Engineering Student at the University of Zambia)

APPENDIX B: QUESTIONNAIRE

Sustainable construction is the design, development, construction, and management of the built environment such that the negative environmental, social, and economic effects of the construction, restructuring, and management of the built environment are reduced as far as possible. The purpose of this questionnaire is to assess the level of sustainable construction practices and investigate its barriers in the Zambian building construction industry.

Please respond to the questions that follow by using a cross sign(X) in the appropriate box or write in the space provided to answer the following questions.

Please note that your response to the questions should be based on your experience.

SECTION A. Respondents Background

1.1 Professional Background

Architect	Construction Manager	Civil/Structural Engineer	Quantity Surveyor	Other (Specify)

1.2 What role in construction does your organisation play?

Contractor	Consultancy	Client/Client Representative	Regulatory Body	Property Developer	Academic/ Lecturer	Other (Specify)

1.3 How long have you worked in the construction industry?

Less than 5 years	5 to 10 years	10 to 15 years	15 to 20 years	More than 20 years

1.4 What type of projects does your organization usually deal with?

Private	Government	Other (Specify)

SECTION B: Knowledge about Sustainable Building Construction

2.1 Are you aware of sustainable building construction?

Yes	No

2.2 If yes to Q2.1, how did you know about sustainable construction? Please tick as many as may apply.

Books/Magazine	
Colleagues	
School (College, University)	
Seminar/Course	
Radio/Television	
Internet	
Other (Specify)	

2.3. What is your level of awareness in sustainable building construction?

Poor	Fair	Good	Excellent

2.4. Are you interested to know more about the concept of Sustainable construction?

Yes	No

2.5. Do you think sustainability is important as part of our community development?

Yes	No

2.6. Please what is your understanding of Sustainable building construction in the
Zambian construction industry?

.....

2.7. Do you think there is enough education and training on sustainable construction in
Zambia?

Yes	No

2.8. Can sustainable construction be promoted in the construction industry?

Yes	No

2.9. If yes to Q2.8, how?

.....

2.10. Is there a current statement or policy that commits you to sustainable construction
methods in procuring building construction projects?

Yes	No

2.11. What sustainability issues does your organization consider most in your operation?
Please Tick as many as may apply.

Economic	
Social	
Environmental	

2.12. What is/are some of the sustainable construction issues that you have ever considered in your projects? Please tick as many as may apply.

Energy and Waste	
Water Pollution	
Air Pollution	
Deforestation	
Destruction of Life forms	
Protection of Endangered Species	
Economic Development of Society	
Promotion of minority interests (women and disabled)	

2.13. In your opinion, to what extent do construction officials make Sustainability decisions?

Very frequent	
Frequent	
Occasionally	
Seldom	
Never	

2.14. Knowledge on Sustainable construction is widespread in Zambia.

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

2.15. Indicate which of the under listed Challenges affect Sustainable Construction in Zambia?

Challenges	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
Lack of capacity of the construction sector					
Turbulent economic environment					
Poverty and perceived high cost of initial investment					
Lack of accurate data					
Lack of interest in the issue of sustainability					
Resistance to technology					
Lack of public awareness					
Lack of research into sustainable building construction					
Little incentive for construction professionals					
Others					

2.16. If others, please indicate below.

.....

2.17. What measures does your organisation undertake to mitigate this / these challenges?
 Please tick as many as may apply.

Education to adapt to situation	
Research and Development to find better ways	
Compensation	
Retrofitting of existing buildings	
Vegetation Restoration	
Others	

2.18. Please specify bellow if others.

.....

.....

.....

2.19. What does your organisation consider as a primary sustainable construction concern in connection with its operations?

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
Disposal of waste or by products					
How to save energy or electricity					
How to conserve water					
Safety at workplace					
How to stimulate local economy					
How to conserve wildlife					

2.20. Do you think sustainable building construction can bring any visible benefits in the construction industry?

Yes	No

Thank you for your assistance!

APPENDIX C: INTERVIEW GUIDE

Organisation/Company: _____

Name: _____

Position: _____

Age: _____

Please tick (✓) your response to the following questions

1. How long have you worked in the construction industry?

- a) ☐ ≤ 2 years. b) ☐ 2-5 years.
c) ☐ 6-10 years d) ☐ 11-15 years
e) ☐ ≥ 16 years

2. What type of organisation/company do you represent?

- a) ☐ Client Developer b) ☐ Contractor
c) ☐ Consultant Firm d) ☐ Government Body
e) ☐ Other Specify: _____

3. What type of projects does your organisation/company undertake?

- a) ☐ Commercial b) ☐ Institutional/Public
c) ☐ Residential

Please respond to the questions below according to your views. Please be reminded that there is no right or wrong answer, and that every data you will provide will be treated with utmost confidentiality.

4. 5. What is your opinion of existing national policies in implementation of sustainable construction?

6. What do you think are the main reasons for using sustainable building construction practices?

7. Is your organisation/company carrying out any sustainable construction projects?

8. What is your company's attitude toward sustainability in the construction sector?

9. What challenges, if any, does your company experience in delivering sustainable building construction projects?

10. What is your company doing to alleviate/eradicate the challenges it experiences, if any, when implementing sustainable building construction projects?

APPENDIX D: ETHICAL CLEARANCE



THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

Telephone: +260 -1- 290258/291777 Ext. 2208
Fax: +260-1-290258/253952
E-mail: drgs@unza.zm

P O Box 32379
Lusaka, Zambia

19th September, 2017

Ref. No. 2017-Aug-001

Mr. Mtonga Gomezga Gregory
C/O School of Engineering
Department of Civil and Electrical Engineering
University of Zambia
P.O Box 32379
LUSAKA

Dear Mr. Mtonga,

RE: FULL ETHICAL CLEARANCE

With reference to your research proposal entitled: **"AN INVESTIGATION INTO SUSTAINABLE BUILDING CONSTRUCTION PRACTICES IN ZAMBIA,"** you are hereby given full ethical clearance to proceed with your research.

ACTION:	APPROVED
DECISION:	18th September, 2017
EXPIRATION DATE:	17th September, 2018

However, it is recommended that all data to be collected should be kept confidential and that if there are plans for publication or dissemination of results, the names of the participants should not be linked with the research in order to ensure confidentiality.

Please note that you are expected to submit to the Secretariat a Progress Report and a copy of the full report on completion of the project.

Finally, and more importantly, take note that notwithstanding ethical clearance given by the NASREC (Natural and Applied Science Research Ethics Committee), you must also obtain authority from the Permanent Secretary of the appropriate Ministry before conducting your research.

Yours sincerely,

Dr. Alice M. Mweetwa
ASSISTANT DIRECTOR (RESEARCH)
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

cc: Director, Directorate of Research and Graduate Studies
Assistant Registrar (Research), Directorate of Research and Graduate Studies

APPENDIX E: JOURNAL PUBLICATION CERTIFICATE

