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DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT

AN INVESTIGATION ON SUSTAINABILITY COMPLIANCE IN THE KENYAN CONSTRUCTION INDUSTRY

(A Perspective of Key Interior Design Professionals in Nairobi City County)

Submitted by

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A Research Project Submitted in Partial Fulfilment of the Requirements for the Award of the Degree of Master of Arts in Construction Management

July, 2019

DECLARATION

DECLARATION BY THE CANDIDATE

I hereby declare this research project is my original work and has not been presented for examination in any other University. No part of this project may be reproduced without prior permission from the author and/or University of Nairobi.

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DEDICATION

This work is dedicated to the Almighty God for his mercies, grace and granting me the ability to undertake this study to its successful completion;

and

My loving parents
Mr. & Mrs. Kamau
For their inspiration, encouragement and support, glad they lived to witness this milestone in my academic journey;

and

My siblings
Magdalene
John and
David
For their encouragement;

and

My late grandfather
Kamau Wangi
For instilling in me the desire to scale heights in academics. May his soul continue resting in eternal peace.

ABSTRACT

This study investigated sustainability compliance in the Kenyan construction industry focusing on the interior design market segment. This focus was informed by the need to have all market segments involved in sustainable construction endeavours. From past literature, independent variables were identified as sustainability literacy, uptake and assessment with the moderating and dependent variables as market segment peculiarities and sustainable construction compliance respectively. The study had hypothesized, in the alternative, the impact of independent variables individually and jointly on dependent variable in the Kenyan construction industry was above average. The phrase above average was based on threshold which for this study was set at a mean of three [Average]. Additionally, the study sought to assess the extent of independent variables, individually and jointly, as key contributors to sustainable construction compliance in Nairobi City County. The targeted population were key practitioners in the Kenyan construction industry. These were identified as architects/interior designers, electrical engineers, mechanical engineers, quantity surveyors and contractors being the typical core team required for a professionally executed interior design project in Kenya. They have the potential to influence project lifecycle towards improved sustainable construction compliance. Sampling frame was defined as actively practicing key professionals as above identified in Nairobi City County. The Yamane (1967) formula was used to compute sample size which was adjusted for non-response resulting in 60 respondents. For the research instruments, structured questionnaires, appropriate measures were taken to ensure their validity and reliability. Lastly, appropriate research ethics considerations were observed. The unit of analysis and observation was the individual key professional. For data analysis, descriptive statistics were mainly through computation of means and standard deviations and inferential statistics through *t*-statistic *p*-value score calculations. Resulting data was presented in form of charts, tables and graphs. Out of the 60 targeted respondents, valid responses were 46 representing a 77% response rate. On hypotheses testing, individually and jointly, sustainable construction literacy, transition/uptake and assessment/evaluation had an above average impact on sustainable construction compliance in the Kenyan construction industry. The findings also established the impact of independent variables on dependent variable in the Kenyan construction industry individually and jointly as above average in Nairobi City County. Additionally, the study highlighted improvement measures for the three independent variables as a means of achieving improved sustainability compliance in the Kenyan construction industry both at policy and practice levels. Recommendations for future research based on the findings of this study were also outlined.

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ABBREVIATIONS AND ACRONYMS

BC	- Before Christ
GNP	- Gross National Product
SDGs	- Sustainable Development Goals
UNDP	- United Nations Development Programme
EMCA	- Environmental Management and Coordination Act
IDAK	- Interior Designers Association of Kenya
IDK	- Institute of Designers of Kenya
BORAQS	- Board of Registration for Architects and Quantity Surveyors
USA	- United States of America
NCIDQ	- National Council for Interior Design Qualification
EBK	- Engineers Board of Kenya
JBC	- Joint Building Council
KABCEC	- Kenya Association of Building and Civil Engineering Contractors Association
NCA	- National Construction Authority
CCTV	- Closed Circuit Television
UPS	- Uninterruptible Power Supply
USGBC	- United States Green Building Council
HKU	- University of Hong Kong
UK	- United Kingdom
UNESCO	- United Nations Educational, Scientific and Cultural Organization
CPD	- Continuous Professional Development
BREEAM	- Building Research Establishment Environmental Assessment Method
EIONET	- European Environment Information and Observation Network
SA	- Sustainability Assessment
ISO	- International Standards Organization
EN	- European Standards
BSAM	- Building Sustainability Assessment Methods
LCA	- Lifecycle Assessment
BEES	- Building for Environmental and Economic Sustainability
ENVEST	- Environmental Impact Estimating Software
LEED	- Leadership in Energy and Environmental Design

SBIS	- Sustainable Building Information System
BLCC	- Building Life Cycle Cost Program
QuickBLCC	- Quick Building Life Cycle Cost Program
LCCID	- Life Cycle Cost in Design Program
GBTool	- Green Building Assessment Tool
SpiRiT	- Sustainable Project Rating Tool
EQUER	- Lifecycle simulation tool providing quantitative indicators of environmental quality
OGIP	- Optimierung der Gesamtanforderungen ein Instrument fur die Integrale Planung
H-K BEAM	- Hong Kong Building Environmental Assessment Method
SI	- Sustainability Indicator
DGNB	- The German Sustainable Building Council
BNB	- Assessment methods of the assessment system for sustainable building (German acronym)
HQE	- High Environmental Quality (French certification system)
CASBEE	- Japanese methodology for computing building environmental efficiency
TQB	- Total Quality Building
BEAS	- Baseline Environmental Assessments
SB Tool	- International Sustainable Building Tool
OPEN HOUSE	- Project for common European assessment methodology for sustainable buildings based on European standards
ENERBUILD	- Project for facilitating training on planning and construction of energy saving and producing buildings in the Alpine space
IOSR	- International Organization of Scientific Research
CSIR	- The Council of Scientific and Industrial Research
ARCOM	- Association of Researchers in Construction Management (UK)
KICEM	- Korea Institute of Construction Engineering and Management
RICS	- Royal Institution of Chartered Surveyors

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

1.1.1 A Brief Overview of Sustainability in the Construction Industry

Mankind has displayed efforts over time geared toward ensuring that human activities are not a threat to both the present and future generations. From as early as the 1st Century Before Christ (BC), impacts of human activities have been a major concern (Pliny the Elder, 1938; Columella, 1948; Strabo, 1949; Van Zon, 2002 and Du Pisani, 2007). Before 18th Century, the main activities in focus were farming, logging and mining. According to Du Pisani (2007), the focus thereafter shifted to population growth impact, consequent increased consumption and depletion of important natural resources like coal which characterised the industrial revolution. It is in the 20th Century that the Brutland Report (1987), one of the most referenced scholarly work on sustainable development, was published. Such concerns for the ability of current and future generations to meet their needs has led to the emergence of drives for adoption of sustainable development practices as they are known today (Du Pisani, 2007). Currently, sustainability is seen to encompass three interdependent dimensions: economic, environmental and social.

Sustainability is arguably one of the greatest challenges to humankind in the 21st Century (Moxon, 2012). According to Murray and Cotgrave (2007), sustainability and sustainable development may be used synonymously to broadly describe practices which consider economic, environmental and social aspects in a bid to meet current needs considering the ability of future generations to meet their own needs. Despite the existence of numerous definitions of sustainability, this study adopts the widely accepted definition as postulated by Brundtland (1987): Sustainability is defined as development that meets the needs of the present generation without comprising the ability of future generations to meet their needs. According to Gollagher et al. (2013), sustainability encompasses complex interactions between economic, environmental and social factors which are normally perceived differently by the various stakeholders. As postulated by (Oni, 2015), there is need for action, sustainable practices, to avoid the negative impacts associated with respective individual and/or collective inaction.

According to Du Plessis (2002), construction industry, with special reference to developing countries as is the case for Kenya, has been identified to impact the environment through direct and indirect linkages with the various industries it relates with. These impacts have been broadly classified into economic ((such as Gross National Product (GNP) contribution, employment creation and as a tool of government control)), environmental (such as materials consumption, energy consumption and greenhouse gases emissions) and social (such as labour relations, business practices and poverty alleviation). Several authors have raised concerns about the main sustainability focus being on environmental and economic aspects with little attention to the social dimension of sustainable development (Njoroge, 2013; Zuo et. al., 2014 and Boyer et al., 2016). In addition, analysis of previous research in relation to sustainability shows limited coverage of the interior design market segment related endeavours compared to general architectural ones (Jones, 2008; Keane, 2009 and Hayles, 2015).

A number of measures have been put in place towards achieving sustainability as an end product of sustainable development practices. This has been driven by the vast negative impacts associated with human activities such as construction. These measures have been identified to range from formal global recognition of the need to pursue sustainable development (Brundtland, 1987), global sustainability agendas such Sustainable Development Goals (SDGs) ((United Nations Development Programme (UNDP), 2017)) and localized sustainable development pursuits such as Vision 2030 in Kenya (UNDP, 2012) – matters economics; local legislation such as Environmental Management and Conservation Act (EMCA) (1999), concerned with environmental matters and Employment Act (2007), largely concerned with social matters to mention but a few. Numerous scholars have pursued matters in relation to aspects of sustainability literacy, uptake and assessment especially in the construction industry in various countries (Usal, 2012; Ikediashi at al., 2013; Khalfan et al., 2015; Higham & Thomson, 2015 and Elmualim & Alp, 2016). These efforts display global efforts towards enriching the theory, and consequently the practice, of sustainability within the construction industry – towards a sustainable construction industry.

1.1.2 Interior Design – A Kenyan Projects Perspective

The interior design market segment in Kenya is composed of three main sub - areas of practice: corporate, retail and hospitality. The corporate sub-area largely covers interior design of office spaces for corporate establishments such as fitting-out an office block. The retail sub-area

covers the interior design for retail outlets such as banking halls, boutiques and fast food outlets. Lastly, the hospitality sub-area covers interior design for hospitality related establishments such as hotels, bars/clubs, restaurants and residentials. In a nutshell, this market segment has been growing over the years owing to rise in population, which has consequently led to increased built environment and the ultimate need to have spaces fit for various functions amongst other requirements especially in Nairobi City County. Little scholarly work exists on the Kenyan interior design practice and thus this study attempts to shed light on the nature of this market segment which is part of the larger Kenyan construction industry.

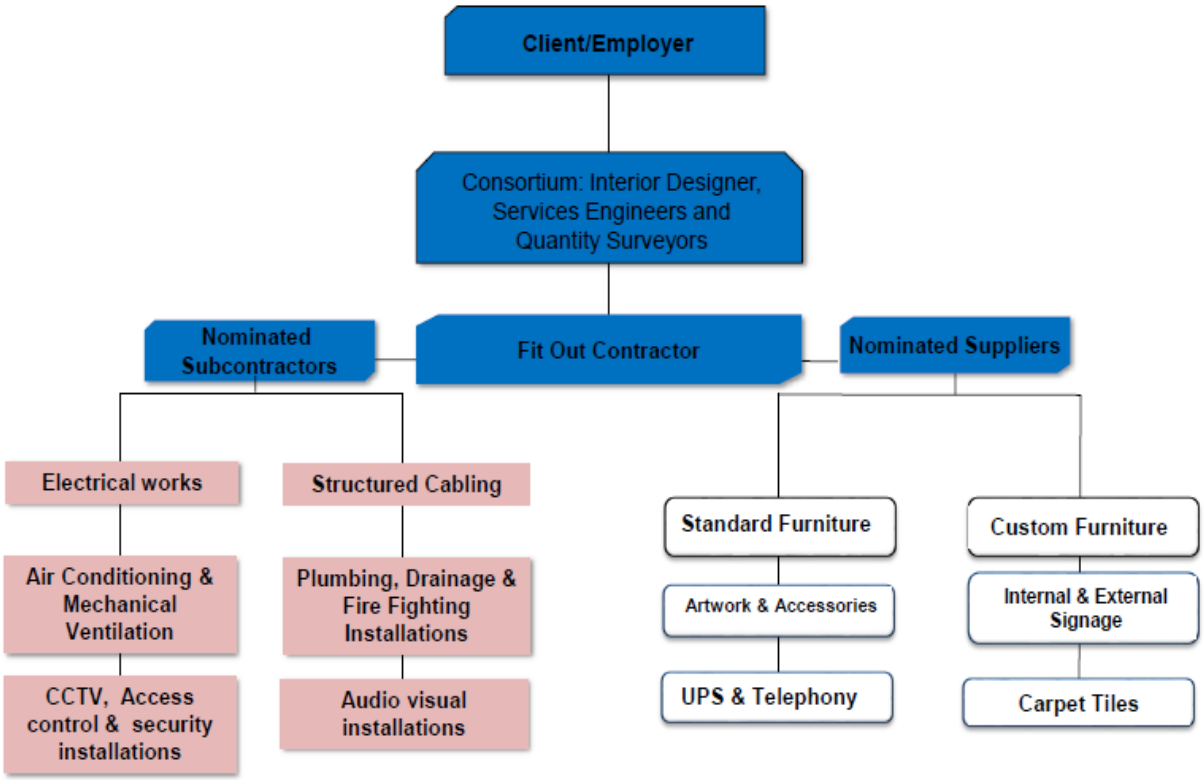
Numerous entities currently pose as interior designers in Kenya ranging from self-taught interior decorators all the way to long-standing professional interior design firms. In between are interior design product suppliers such as wallpaper stockists, diploma and degree graduates (employed), diploma and degree graduates (self-employed) and newly formed interior design firms amongst other entities. This situation can be attributed to the fact that the sector is yet to get regulation by an oversight authority with the backing of an Act of Parliament. As such, there exists no stringent regulations governing the practice. It is however worth noting that over time, clients are becoming more aware of the need to engage a duly qualified and/or experienced interior designer/interior designers. However, the fact that countless quacks are out there posing as interior designers is undeniable. Oversight bodies for interior design practice in Kenya, Interior Designers Association of Kenya (IDAK) and Institute of Designers of Kenya (IDK) are in their formative stages. A draft bill, The National Design Bill (2015), is also yet to be tabled in parliament and is meant to regulate interior design practice in Kenya.

This study focuses on professional interior design practice; where the involved parties are professionals in their respective fields. In the course of planning, designing, executing and post-construction support in interior design projects (Fit-out and retro-fits), interior designers require the input of other professionals. The main ones are quantity surveyors, electrical engineers and mechanical engineers. However, over time, given the rising complexity in interior design projects, additional professionals are required on an ‘as and when required’ basis. These include but are not limited to: lighting consultants/designers, structural engineers (Where structural alterations are involved), security professionals, construction project managers and construction project administrators. The conduct of these professionals in interior design projects, in Kenya, is largely governed by consultancy agreements. However, the general oversight of these professionals is undertaken by the respective professional bodies

such as Engineers Board of Kenya (EBK) for engineers and the various Acts of Parliament and parastatals that regulate various aspects of the built environment.

Apart from consultants/professionals, there are other stakeholders in interior design projects. Amongst them are the project clients/employers who engage the consultants/professionals (discussed above) and the construction team. The construction team is typically composed of contractors (domestic and/or nominated) and can be ordinary fit-out contractors and/or specialists, sub-contractors (domestic and/or nominated) and suppliers (domestic and/or nominated). The conduct of the construction team in interior design projects, in Kenya, is largely governed by contract agreements such as the Joint Building Council (JBC) conditions of contract for building works and sub-contract agreements such as Kenya Association of Building and Civil Engineering Contractors Association (KABCEC) sub-contract agreement. The general oversight of these entities is undertaken by National Construction Authority (NCA) and the respective county governments (For the jurisdiction in which the construction works are being undertaken). A typical organization structure for an interior design project is illustrated in Figure 1.1 below:

Figure 1.1: Typical Organogram for an Interior Design Project



Source: Author (2018)

1.1.3 Towards a Sustainable Construction Industry

This study focused on the interior design market segment of the construction industry in Kenya bearing in mind the limited sustainability research. The study aimed at establishing the level of sustainability (economic, environmental and social dimensions) literacy levels including contribution of the various options of sustainability learning. Secondly, it sought to establish the extent of sustainability uptake including the key factors (Drivers and barriers) that influence the uptake of sustainable construction practices. Lastly, the study set-out to establish the extent of sustainability assessment in construction projects including identifying familiarity levels on assessment standards/methods/tools, operational measures of value for sustainability and assessment frameworks encompassing the three dimensions of sustainability. The aim was to contribute to the ongoing discussion geared towards a comparatively sustainable construction industry. This could be done by promoting improved sustainability literacy, leveraging the drivers of sustainable construction practices while suppressing the barriers and enhanced evaluation of sustainable construction practices. The key interior design market segment professionals for purposes of this study were interior designers/architects, quantity surveyors, electrical engineers, mechanical engineers and fit-out contractors. This was informed by the fact, they constitute the typical core team required for planning, design, implementation and post-implementation review of a typical professionally executed construction project in Kenya as identified in Section 1.1.2. Consequently, in light of their implied potential to influence the entire project lifecycle, it can be argued that they are key to sustainability compliance in construction projects. These professionals were drawn from the pool of active practitioners in the interior design market segment of the Kenyan construction industry for purposes of data collection.

1.2 Problem Statement

The construction industry provides requisite physical infrastructure (built environment) that accommodates the needs of society (Muhwezi et al., 2012). According to Du Plessis (2002) the impacts of the construction industry in the course of developing the built environment, within the context of sustainability, can be grouped into economic, environmental and social impacts. Environmental impacts are exhibited through demand for natural resources, energy consumption in processing of construction products and emission of greenhouse gases during processing of construction products like cement. According to Macozoma (2002), construction is responsible for 25% of the harvested wood, 30-40% of energy consumption and 20-30% of

greenhouse gas emissions. Social impacts are evident through corruption, unfair labour practices, discrimination, sexual harassment, low health and safety compliance levels to mention but a few. Lastly, economic impacts can be seen through percentage of capital investment, GNP contribution, cost of constructed facilities, and proportion of labour employed in the construction industry. According to Du Plessis (2002), these impacts are described to be more severe in developing countries, such as Kenya, compared to their developed counterparts.

These negative economic, environmental and social impacts associated with the construction industry highlight the implied key role of this industry in the sustainability agenda (Opuku & Fortune (2013). This calls for immediate action given the numerous direct and indirect links that the industry has with other industries and hence the widespread nature of its impacts economically, environmentally and socially (See Section 1.1 above). Retail ventures such as boutiques and fast food joints, hospitality ventures like hotels and residentials and lastly corporate ventures such as offices take up spaces in constructed facilities. However, there is always the tendency for such ventures to customize their interior work environment in light of their brands and/or other preferences. This is where interior design comes in to deliver the required interior work environments through projects that customize interior spaces to user requirements under the oversight of requisite professionals. With the ever-increasing built facilities coming up in and around Nairobi, the requirement for designed interior spaces is on a rising trajectory. This highlights the magnitude of the interior design market segment despite lack of centralized data. As such, it is evident that the market segment has a key potential role in contributing positively towards a sustainable construction industry.

Interior design, as a market segment, needs to be part and parcel of the efforts by the larger construction industry in ensuring sustainability in the construction industry. Most of the information, legislation and assessment tools have been largely geared towards architectural projects though some aspects are still applicable in interior design projects. There are certain key features of interior design projects that justify the need for efforts to promote sustainability in this market segment. These include the fact that interior design projects are normally within the constraints of an existing building availing fewer options for passive approaches compared to architectural projects. Additionally, interior design projects have a shorter lifetime compared to architectural projects. This potential high rate of change of interior environments present an opportunity for exploration to enhance lifecycle sustainability of constructed facilities. A sustainable approach to interior design projects does not necessarily mean compromised

aesthetics. It is basically a project lifecycle approach addressing current needs considerate of future generation's capacity to meet their own needs (Moxon, 2012). It cannot be over-emphasized that the interior design market segment of the construction industry has been noted to have limited scholarly work compared to the general architectural market segment (Jones, 2008; Keane, 2009 and Hayles, 2015).

Despite the above highlighted need for inclusion of the interior design market segment in construction industry sustainability related endeavours, interior design as a practice has been largely ignored in Kenya. As postulated by Mwanza (2013), there are no clear-cut professional qualifications for an interior designer, unlike in South Africa, for example, where interior design is a recognized and regulated profession within the built environment. Additionally, there exists no well-developed professional association in Kenya governing the practice nor an Act of Parliament backing the same. Two entities, IDAK and IDK are in their formative stages trying to fill this regulatory gap. The latter has drafted an Act of Parliament, The National Design Bill 2015, set to be tabled in parliament for discussion. CAP 525 laws of Kenya, The Architects and Quantity Surveyors Act 2010, refers interior design as part of the work of the Architect despite there being duly trained and experienced interior design professionals. Board of Registration for Architects and Quantity Surveyors (BORAQS) practice notes 1960 -2013 (BORAQs - Kenya, 2018) postulate that the construction market lacks formally trained professionals to practice as interior designers. As such, they argue that the Architect is best placed to assume the role of a professional interior designer. The proposed Built Environment Practitioners Bill 2017 partly seeks to regulate the training, registration and licensing of professional interior designers. As highlighted by Mwanza (2013), for other countries such as Britain, United States of America (USA), Australia, China, Brazil, Nigeria and South Africa, interior design is recognized as a distinct profession which is appropriately regulated and with fully fledged professional associations.

This drives the quest to establish the extent of sustainability literacy, transition and assessment in the Kenyan interior design market segment. To achieve this, the study set out to establish the perspectives from key professionals in interior design projects. These key professionals, for the purpose of this study, comprised of interior designers/architects, quantity surveyors, mechanical engineers, electrical engineers and contractors. This enabled the study to propose sustainability solutions that are cognisant of the status and the various issues in the interior design market segment. The study seeks to enrich the body of knowledge on sustainability in

interior design to stimulate improved sustainable construction practice in this construction industry market segment. Additionally, this research gap as explored in this study will complement the vast research on sustainability in the larger construction industry. This is intended to contribute to a wholesome understanding of sustainability in construction.

1.3 Research Hypotheses

The study adopted the method postulated by Leedy & Ormrod (2005) that a researcher can have a main hypothesis which is accepted if and only when all the supporting sub-hypotheses are accepted. Additionally, the main hypothesis is rejected if any or all of the supporting sub-hypotheses are rejected. In order to provide a detailed description and analysis of the prevailing situation, regarding sustainability literacy, uptake and assessment, in the interior design market segment of the Kenyan construction industry, this study tested one main hypothesis and 3 sub-hypotheses. Means and standard deviations were obtained for each variable as computed from the 5-point Likert scale (1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good) frequency scores to facilitate ranking. The phrase above average was adopted based on the need to have a threshold which for this study was set at a mean of three [Average]. As such a mean greater than three implied above average while less than or equal to three implied not above average. Amongst key professionals in the Kenyan construction industry, the hypotheses were as outlined below:

1.3.1 Main Hypothesis on Construction Industry Sustainability Compliance

H_0: Null hypothesis

The joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainability compliance is not above average.

H_A: Null hypothesis

The joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainability compliance is above average.

1.3.2 Sub - Hypothesis 1 on Sustainability Literacy in the Construction Industry

H_0: Null hypothesis

The impact of sustainability literacy on sustainability compliance is not above average.

H_A: Alternative hypothesis

The impact of sustainability literacy on sustainability compliance is above average.

1.3.3 Sub - Hypothesis 2 on Sustainability Transition/Uptake in the Construction Industry

H_0: Null hypothesis

The impact of sustainability transition/uptake on sustainability compliance is not above average.

H_A: Alternative hypothesis

The impact of sustainability transition/uptake on sustainability compliance is above average.

1.3.4 Sub - Hypothesis 3 on Sustainability Assessment/Evaluation in the Construction Industry

H_0: Null hypothesis

The impact of sustainability assessment/evaluation on sustainability compliance is not above average.

H_A: Alternative hypothesis

The impact of sustainability assessment/evaluation on sustainability compliance is above average.

1.4 Research Questions

Below outlined is the overarching research question that the study aimed to answer:

What is the individual and joint impact of construction sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in Nairobi City County?

Specifically, the study aimed to answer the following questions:

i. What is the extent of construction sustainability literacy as a key contributor to sustainable construction compliance in Nairobi City County?
ii. What is the extent of construction sustainability transition/uptake as a key contributor to sustainable construction compliance in Nairobi City County? and
iii. What is the extent of construction sustainability assessment/evaluation as a key contributor to sustainable construction compliance in Nairobi City County?
iv. What is the joint impact of construction sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in Nairobi City County?

1.5 Objectives of the Study

This study sought to pursue the below outlined main and specific objectives.

1.5.1 Main Study Objective

The main aim of this study was to examine the status of sustainability literacy, uptake and assessment in the interior design market segment of the Kenyan construction industry in Nairobi City County.

1.5.2 Specific Study Objectives

The specific objectives below were used to achieve the above stated general study objective:

i. To establish the extent of construction sustainability literacy as a key contributor to sustainable construction compliance in Nairobi City County;
ii. To establish the extent of construction sustainability transition/uptake as a key contributor to sustainable construction compliance in Nairobi City County;
iii. To establish the extent of construction sustainability assessment/evaluation as a key contributor to sustainable construction compliance in Nairobi City County; and
iv. To establish the joint impact of construction sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in Nairobi City County.

1.6 Significance of the Study

The construction industry has been described as having a low sustainability (Economic, environmental and social) compliance reputation. This has been due to issues such as having sizeable number of constructed facilities with no appropriate access for physically disabled persons, materials sourcing in a manner detrimental to the natural environment and inconsiderate lifecycle costs to mention but a few. The interior design market segment is part of the construction industry and is therefore included in this low sustainability compliance reputation. As such, the interior design market segment of the Kenyan construction industry was particularly selected for this study to expose its potential in complementing sustainability endeavours in the larger construction industry. Additionally, this was necessitated by the lack

of effective regulation for the market segment and limited scholarly work relating to both the market segment and its sustainability endeavours.

This study intended to provide a frame of reference for future scholars in the same research field to facilitate enrichment of sustainable construction body of knowledge as pertains to interior design projects. Furthermore, with the rising trajectory of interior design projects in Kenya, it is hoped that this study will provide an understanding as to the interior design market segment to facilitate the development of context appropriate sustainability approaches and solutions. The study hopes that this will be through the key interior design project professionals fostering appropriate sustainability literacy, uptake and assessment over the lifecycle of the projects they are involved in. The study also hopes that regulatory authorities and/or institutions spearheading the sustainability agenda in the construction industry will be able to identify from this study areas that may be targeted for improvement to promote and foster sustainable construction compliance.

1.7 Definition of Key Terms as Used in this Study

Sustainability

Sustainability refers to development that ensures the ability of the present generation to meet their own needs (Intra-generational equity) without compromising the ability of future generations to meet their own needs (Inter-generational equity). This definition covers the associated economic, environmental and social aspects in a given context (Brundtland, 1987 & Carboni et al., 2018).

Interior Design Market Segment

The construction industry market segment which deals with an already existing indoor space in a constructed facility (may include surrounding external areas) charged with offering creative, technical and business solutions with an overall aim of providing functional space (s), enhanced user quality of life, enhanced culture and an aesthetically appealing indoor space and/or associated external areas subject to project client requirements ((National Council for Interior Design Qualification (NCIDQ), 2018 & Million Insights, 2018)).

Sustainability Literacy

Sustainability literacy is the mastery/proficiency of sustainability skills and knowledge aimed at fostering practices that ensure the planet meets the needs of the current generation without compromising the ability of future generations to do so (Dale & Newman, 2005 and Murray & Congrave, 2007).

Sustainability Transition/Uptake

Sustainability transition/uptake is a multi-faceted, long term change of established social-technical set-ups to comparatively sustainable consumption and production modalities involving change in socio-technical systems and at the same time appropriately changing the criteria with which the various stakeholders judge products, services and systems (Markard et al., 2012 & Kemp & Lente, 2011).

Sustainability Assessment/Evaluation

Any process geared at advancing understanding, contextualization and influencing uptake of sustainability to steer associated decision making towards managing sustainability (economic, environmental and social) problems and issues (Waas et al., 2014) - The definition has been postulated to allow interchangeability of the term's sustainability assessment and sustainability evaluation.

Sustainable Construction

Sustainable construction is the total process that ensures and maintains balance between the built and natural environments (environmental considerations) while at the same time upholding human dignity (social considerations) and ensuring economic equity amongst the populace (economic considerations) – (Du Plessis, 2002).

1.8 Scope of the Study

The extent of subject matter of this study can be split into three main dimensions namely theoretical, methodological and geographical as below described:

Theoretically, the focus of the study was limited to sustainability literacy, uptake/transition and assessment/evaluation as key contributors to sustainability compliance in the construction industry. The construction industry has known negative impacts of economic, environmental

and social nature which are encompassed in the three dimensions of sustainability. It is in this implied call for action to the construction industry that this study found it appropriate to focus on sustainability compliance in construction. This was ultimately aimed at contributing to the bigger discussion as to how the construction industry can shift towards comparatively sustainable modes of operation.

Methodologically, the unit of analysis and observation was the individual professional (interior designer/architect, electrical engineer, mechanical engineer, quantity surveyor and contractor). Consequently, this study does not offer difference in perspectives between professionals in private and public sectors including micro, small, medium and large sized enterprises from which these professionals are selected from. This was based on the fact that despite the sector or size, the typical roles of these identified key professionals are almost similar, if not similar, for different sectors and/or firm sizes. As such, focus on a specific sector or firm level would not have had significant contribution to the study.

Lastly, geographically, the study was conducted in Nairobi City County in Kenya. This was chosen by the researcher because of ease of accessibility since the researcher resided in the said County during the course of this study. Additionally, this locality was also reinforced by the fact that Nairobi City County has a comparatively bigger economy than other Counties in Kenya. This implies that the construction industry is typically more vibrant and active in Nairobi City County comparatively hence a good subject of study from which findings can be generalized to the other Counties. However, the study having focused only in Kenya, applicability of the research findings to other countries is subject to further scientific research in such countries.

1.9 Assumptions of the Study

This study was based on the following assumptions:

i. Project teams in Nairobi City County are similar to their respective counterparts in the other Kenyan Counties;
ii. The recommendations from this proposed study will be applicable to other counties in Kenya as implied in assumption (i) above;

iii. Ethical concerns have been appropriately addressed in the study to ensure that the findings of the study will not have any negative effects on participants and other persons; and

iv. The effect upon dependent variable is attributed to solely the three independent variables and not any other variable (s).

1.10 Limitations of the Study

This study was subject to the following limitations:

i. Due to time and resource constraints, the study focused on project teams in Nairobi City County as this was the researchers' County of residence at the time of this study;

ii. Due to time and resource constraints, the study drew project professionals in Nairobi City County from completed and ongoing projects between the years 2016-2018;

iii. The study focused only on the perspectives of only 5 categories of key professionals in interior design projects (Interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and contractors);

iv. Interior design market segment has limited scholarly work and thus much of the information on the Kenyan market segment was primary information obtained by the researcher in the course of the study;

v. Sustainable construction in interior design market segment has limited scholarly work and thus much information relied upon in this study was sourced from literature on sustainability in the general construction industry;

vi. The interior design market segment in Kenya lacks appropriate regulation and thus there was no centralized data as to the list of interior design projects from which a sample could be drawn from; and

vii. Despite there being many parameters that contribute to sustainable construction compliance in the construction industry, due to time and financial constraints, the study limited its focus to sustainability literacy, uptake and assessment aspects only.

1.11 Organization of the Study

This study is organized in 5 sections as outlined next page:

Chapter one, Introduction, gives the context of this study. It covers the general introduction to sustainability and interior design, outlines the problem statement of the study, presents the study hypotheses, research questions and objectives, outlines the justification/significance of the study and provides the definitions of key terms as used in this study. Additionally, this chapter outlines limitations and assumptions underlying the research.

Chapter two, Literature Review, covers an in-depth study of past scholarly work aligned to the research objectives and questions, as identified in Chapter 1, and provides the way forward through a conceptual framework and a presentation of the resulting variables (Independent and dependent). The conceptual framework anchors the manner in which Chapter 3 and Chapter 4 were developed.

Chapter three, Research Methodology, covers an in-depth explanation of the research design, methods and techniques as well as the procedure (Including tools) adopted to collect and analyze data for the study including the associated rationales and assumptions. The discussion provides explanation as to how the data was collected and analyzed to best address the research problem (hypotheses and questions).

Chapter four, Data Analysis and Presentation, presents summaries of data that was collected, analyzed and presented in the form of tables, charts and graphs. These are accompanied by a discussion to explain the outcomes of the field investigation. Additionally, the chapter analyzes and presents the research respondents perspectives on matters sustainability literacy, uptake and assessment.

Chapter five provides a **Summary of Findings, Conclusions and Recommendations** of the study**.** The discussion is developed in line with the research questions and hypothesis, including the resulting conclusions. Recommendations for policy and practice arising from the research findings are additionally provided. Lastly, areas that require further research, as implied in this study, are also highlighted.

1.12 Conclusion

In this chapter, a background as to sustainability in construction, with specific focus to the interior design market segment of the construction industry, was offered. Additionally, the

problem statement which anchors this study and the hypotheses that the study intended to test including the associated research questions and objectives were outlined. Further to this, the significance, scope, assumptions and limitations of this study were discussed. A review of past literature on sustainability literacy, uptake/transition and assessment/evaluation as key contributors towards sustainability compliance in the construction industry, including the way forward, is presented in Chapter 2.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on various aspects relating to sustainability literacy, transition/uptake and assessment/evaluation to come up with a conceptual framework that guides this study. The chapter first reviews the nature of interior design generally and how interior design relates to sustainability in the construction industry. The chapter also reviews concept of sustainability, the nature of sustainability in the construction industry, sustainability literacy and sustainability literacy channels in the construction industry. The chapter further reviews sustainability transitions, the nature of such transitions and the various factors that drive and impede such transitions. Lastly, the chapter reviews the nature of sustainability assessments (SA), sustainability indicators (SI), and a framework for assessing sustainability in construction projects. This review culminates in a conceptual framework which steered this study in subsequent chapters 3, 4 and 5. The conceptual framework influenced the manner in which the questionnaire was developed together with the questions therein (see Appendix 4). An illustration as to the resulting independent and dependent variables is also provided at the end of this chapter.

2.2 Interior Design – An Overview

This section presents an overview of interior design, through a discussion centered on a general and global market perspective, and sustainability in interior design projects.

2.2.1 Interior Design – A General and Global Market Perspective

NCIDQ (2018) defines interior design as a multi-faceted profession which applies creative, technical and business solutions to a space to ensure functionality, improved quality of life, enhanced culture and aesthetically pleasing interior environment. According to Million Insights (2018), interior design is the art of developing and decorating interior environments, and may incorporate the surrounding exterior areas, to client requirements. From the above, interior design as a profession is seen to possess the following key features as:

i. It deals with an indoor space in a built facility;
ii. It may deal with surrounding external areas;

iii. It offers creative, technical and business solutions;
iv. Its overall aim is on a functional space, enhanced user quality of life, enhanced culture and an aesthetically appealing indoor space and/or associated external areas; and
v. It is subject to project client requirements.

Million Insights (2018) postulates that the scope of interior design services has been noted to significantly expand globally. This has been attributed to the increase in the global middle-class population given their need to stand-out in the society. According to NCIDQ (2018), the scope of services in interior design projects includes, but is not limited to, the following:

i. Project management services – including scheduling and project budget preparation;
ii. Client requirements research and analysis;
iii. Formulation of preliminary space plans based on item (ii) above;
iv. Safety, functionality, aesthetics, public health, safety, accessibility and sustainability review of the preliminary space plans to ensure that client requirements are met;
v. Preparation of construction drawings such as space plans and ceiling layouts;
vi. Collaboration with the other involved consultants such as building services engineers to develop construction packs for the respective scopes of work;
vii. Review of the construction drawings to ensure compliance with appropriate codes, standards, statutes, regulation and guidelines;
viii. Selection of materials, furniture, fixtures, fittings and finishes in line with the pre-set project expectations and limitations;
ix. Contract documentation for materials, furniture, fixtures, fittings and finishes to facilitate appropriate procurement;
x. Contract documents administration, bidding and negotiating on behalf of the project client as their agent; and
xi. Contract administration (during and after construction as may be required), including monitoring, control and reporting.

The global interior design market is segmented geographically. The major segments are North America, Asia Pacific, Europe, South America, Middle East and Africa regions. The North America region is the largest region with notable consistent rise in Asia Pacific and Europe regions. The market size forecast for the year 2021 is 182,000 million United States (US) Dollars. As of 2016, its size was 119,700 million US Dollars from 92,100 million US Dollars in 2013, implying a steady growth of 9.12%. This is despite the decline in the world economic

growth rate which consequently had a slowdown effect on the interior design market segment size. However, as a market segment, interior design has been observed to be on a rising trajectory. This has been attributed to increased disposable income, improved standards of living, lifestyle changes, enhanced awareness, increased innovations and technological advancement (Market Research Store, 2017).

2.2.2 Sustainability in Interior Design Projects

With the built environment growing faster than the global population, the central role of built environment in sustainability (Economic, environmental and social aspects) endeavors is clear ((United States Green Building Council (USGBC), 2007)). In the role of built environment towards a sustainable construction industry inherently lies the consequent role of interior built environment in general. This is even more evident when the sustainability impacts that pertain to the interior of constructed facilities are put into perspective. Interior design has a bearing on environmental effects of constructed facilities, health and wellbeing of indoor spaces users including their productivity (Bonda & Sosnowchik, 2007). Interior design projects, just like general architectural projects, have impacts relating to the economic, environmental and social dimensions of sustainability. As postulated by Markelj et al. (2014), the environmental impacts pertain to energy and water use monitoring to ensure efficiency, use of locally sourced materials to minimize energy and wastes associated with importation amongst other aspects. On social aspects, impacts are related to health and wellbeing such as visual, thermal, air quality, comfort and accessibility by physically challenged persons. Lastly economic impacts relate to productivity of users of indoor spaces, property value and life cycle cost efficiency.

Sustainability is recognized as one of the many aspects of interior design as a profession (NCIDQ, 2018). Despite the increased awareness among interior design key professionals, including support by their respective firms, sustainability is yet to become part of the design process officially. This is a key characteristic of the traditional interior design process (Kang & Guerin, 2009). Key interior design project professionals (architects/interior designers, building services engineers, quantity surveyors and contractors) have a unique opportunity to ensure sustainability in interior design projects. This is because they directly have influence on sustainability related design and financial aspects including construction and finishing process and materials. These spheres of influence are discussed in detail in Section 2.5.4. Apart from project sustainability influence, it has been observed that, outside Kenya, some of these professionals

have become leaders on sustainable construction related matters outside the confines of their respective professional associations (Templeton, 2011).

Interior design projects are a part of the general construction industry. As such they have their fair share in the negative sustainability (economic, environmental and social aspects) impacts associated with the construction industry as identified in Section 1.2. With projects being designed and managed by requisite professionals, they have an implied role of steering the construction industry towards sustainability compliance. The interior design market segment thus has to be involved in efforts by the construction industry to manage the negative sustainability (economic, environmental and social) related impacts segment if such efforts are to be wholly successful. Consequently, professionals involved in interior design projects are charged with incorporating appropriate sustainability related approaches and components in their projects. Thus, in the sustainability quest for the construction industry, the interior design professionals have an implied call for action. This call for action is of a dual nature, both at project professional's individual and collective capacities.

2.3 Sustainability Literacy in the Construction Industry

2.3.1 Sustainability Concept

Sustainability can be used synonymously with sustainable development (Murray & Cotgrave, 2007; Zoufa & Ochieng', 2016). According to Brundtland (1987), despite the numerous and different definitions, sustainable development refers to development that ensures ability of present generations to meet their own needs without compromising the capacity of future generations to meet their own needs. This definition of sustainable development has been widely accepted in scholarly works on sustainability and is the one adopted in this study. Curwell et al. (1998), outlines different scales of sustainability based on the area covered. These are global, regional, territorial, national, municipal, street, construction, system and component scales. Their scope ranges from global agendas for sustainability such as SDGs to the other extreme of specific components, such as sustainability compliant products, that promote sustainability endeavours.

Sustainability has three inseparable and integrated dimensions namely economic, environmental and social ((University of Hong Kong (HKU) Architecture, 2002 and Yilmaz & Bakis, 2015)). This is the viewpoint adopted by this study given its wide acknowledgement in

past scholarly works. Several authors have expressed concern on the much attention given to economic and environmental dimensions with comparatively limited scholarly work on the social dimension (Njoroge, 2013; Zuo et. al., 2014 and Boyer et al., 2016). The economic dimension is concerned with capital investment, GNP contribution, employment creation and decrease in cost through efficiency amongst other aspects. The environmental dimension is concerned with materials consumption, energy consumption, protection of cultural and historic environments and greenhouse gases emissions amongst other aspects. Lastly the social dimension is concerned with labour relations, business practices, consideration of disabled society groups and poverty alleviation amongst other aspects (Du Plessis, 2002 and Yilmaz & Bakis, 2015).

Economic dimension of sustainability has been used as the traditional measure of business performance. It covers the question of how effective and efficient a business is in ensuring competitiveness in the larger business environment. Business models solely focusing on the economic dimension have been identified to be detrimental to natural resources endangering both current and future generations. Economic project product and process impacts can be classified as return on investment, business agility and economic stimulation. Elements of return on investment are: benefit-cost ratio, direct financial benefits, external rate of return, internal rate of return and net present value. The components of business agility are business flexibility and increased flexibility. Lastly, elements of economic stimulation are local economic impact and indirect benefits (Carboni et. al., 2018).

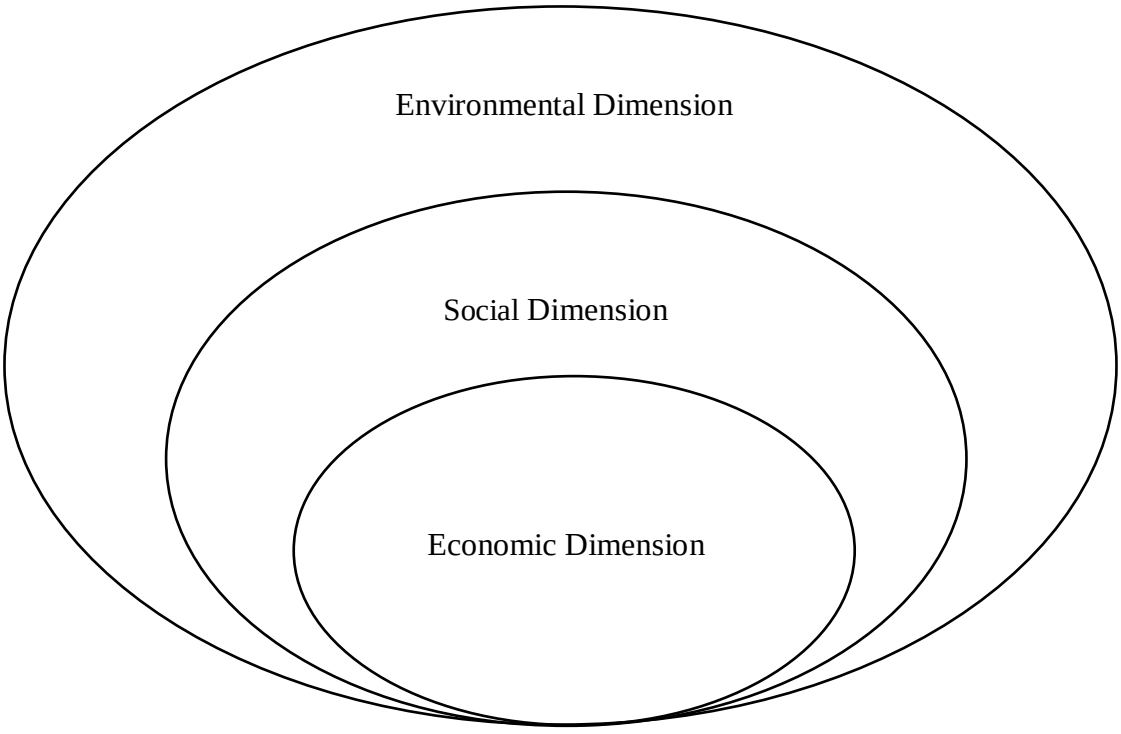
Environmental dimension concentrates on how conscious a business is on its impacts on natural environment. Environmental project product and process impacts can be classified into transport, energy, water and consumption. Elements of transport are local procurement, digital communication, travelling and logistics. The components of energy are energy consumption, carbon emissions, clean energy return and renewable energy. Items under the water category are water quality, water consumption and sanitary water displacement. Lastly, elements of consumption are recycling, disposal, contamination and pollution including waste (Carboni et. al., 2018).

Social dimension concerns itself with social responsibility on the part of the business on quality of life of all affected people. Social project product and process impacts can be classified into labour practices and decent work, society and customers, human rights and ethical behaviour.

Elements of labour practices and decent work are employment and staffing, labour relations, health and safety, training and education, organizational learning, diversity, equal opportunity and local competence development. Society and customer aspects comprise of community support, public policy, customer health and safety, product and service labelling, market communications (Including advertising) and customer privacy. Human rights elements include non-discrimination, child labour and forced labour. Lastly, ethical behaviour concerns include investment practices, procurement practices, bribery, corruption and anti-competitive behaviour (Carboni et. al., 2018).

However, in regards to the above discussed three dimensions, this study agrees with Carboni et al. (2018) that the dimensions are not overlapping as reported in past scholarly works. These postulations assumed that the economic, environmental and social aspects of a given socio-technical set-up are purely interacting but independent which is not the case. Instead, environment emerges to be the larger dimension in which the society is hosted with the economy being nested by the society. As such the economic dimension is fully contained in the social dimension which is in turn fully contained in the environmental dimension. This is as illustrated in Figure 2.1 below:

Figure 2.1: Sustainability Dimensions Illustrated



Source: Adapted from Carboni et al. (2018)

2.3.2 Sustainability in the Construction Industry

As postulated by Du Plessis (2002), sustainable construction is the total process that ensures and maintains balance between the built and natural environments (environmental considerations) while at the same time upholding human dignity (social considerations) and ensuring economic equity amongst the populace (economic considerations). Construction activities, whether in general architectural projects or interior design projects, are crucial for the general progression of a society and economy. Constructed facilities avail infrastructure required to fulfil the various accommodation needs of the society (Living, social and/or business). In course of execution of construction, the activities involved have been known to cause negative environmental impacts which are part of the sustainability concerns (Medineckiene et al., 2010). The social aspects associated with construction activities cannot be overlooked either. These include, but are not limited to, matters of labour (employment matters), ethics and social corporate responsibility. From the above, it is evident that construction related activities have significant sustainability (economic, environmental and social) impacts. The nature and extent of these impacts is as described below.

The construction industry is a major sector in any economy. The industry is also used by governments to regulate the economy through monetary and fiscal actions (Bosher et al., 2007). The industry is also labour intensive hence a major employer. The industry is also characterized by many forward and backward linkages with other industries (Construction Products Association, 2007). Compliance with the economic aspects of sustainability can help investors avoid increased exposure to green taxes, safeguard their reputation and avoid resistance for pressure groups (Adetunji et al., 2003). In addition, according to Kats (2003), the benefits of observing this principle of compliance with economic sustainability include rationalized operating and maintenance costs and increased revenue which can be realized through sale and/or rent of constructed facilities.

According to Tam et al. (2006), construction activities impact on the environment through its activities such as use of natural resources and through its waste products like dust and gas emissions. Construction also impacts on the environment through energy consumption. It is estimated that construction uses 40% of the total energy produced (Cheng et al., 2008). According to Kats (2003), if observed, this principle of compliance with environmental sustainability can be associated with improved quality of the surroundings and rationalized use of natural resources and energy. The environment aspect of sustainable construction is fairly

well researched and more advanced than the social and economic aspects. This could explain the availability of well-established environmental management systems (UK Green Building Council, 2009).

According to Adetunji et al. (2003) social aspects are concerned with the legal and moral obligations of the construction industry to its stakeholders such as employees, suppliers, and the community in which it operates at large. Non-compliance with the social concerns has seen the construction being branded as dirty, disruptive, dangerous, old fashioned and sometimes dishonest (Addis & Talbot, 2001 and Myers, 2005). Also, the quality of spaces should not have negative effects on the users such as poor indoor air quality leading to diseases such as cancer (Baum, 2007 and Kibert, 2008). According to Kats (2003), the benefits of observing this principle of compliance with social sustainability include enhanced wellbeing, reducing abseentism from work, reduced rate of employee turnover and reduced liabilities.

2.3.3 Sustainability Literacy

Construction activities have been associated with negative impacts of economic, environmental and/or social nature as discussed in preceding sections. To counter such negative impacts and to realize the numerous benefits associated with sustainable development, requisite skills and knowledge are required to guide practice. This is meant to facilitate a paradigm shift, as postulated by Murray & Congrave (2007), amongst the construction industry stakeholders towards a comparatively sustainable construction industry. According to Dale & Newman (2005) literacy is the mastery/proficiency of skills and/or subject matter in context. According to Murray & Congrave (2007), there is increased need for sustainability literate professionals in efforts geared towards having a planet that meets the needs of the current generation without compromising the ability of future generations to do so.

This leads to the following integrated definition of sustainability literacy by this study:

Sustainability literacy is the mastery/proficiency of sustainability skills and knowledge aimed at fostering practices that ensure the planet meets the needs of the current generation without compromising the ability of future generations to do so.

Dale & Newman (2005) postulates that matters relating to environmental sustainability dimension such as climate change, economic matters such as consumption levels and social matters such as poverty levels are complex. Sustainability literacy aims at facilitating a better understanding of the sustainability dimensions interactions with an aim of ensuring informed practice. Xia & Pienaar (2016) highlight the important role that higher learning institutions have in equipping industry practitioners with sustainability knowledge and skills. According to United Nations Educational, Scientific and Cultural Organization (UNESCO) (2018), SDG goal number 4 is concerned with quality education. Target 4.7 of this goal highlights the important role of education in ensuring sustainable development. The target is aimed at ensuring that by the year 2030, all learners are equiped with skills and knowledge to facilitate sustainable development and way of living.

According to Lockhart (2016), learning takes place in the life of a human being from birth till death. Over this period, formal, informal and/or non-formal education, or any of their combination takes place. Formal education/learning involves well identified and assessable inputs for example tutors, processes such as teaching methodologies and outcomes like knowledge and skills. Informal learning on the other extreme is largely unstructured. It is basically acquisition of knowledge and skills through experience. Non-formal learning is a middle ground between formal and informal learning with clear outcomes and is semi-structured. Target 4.7 of the sustainable development goals aims at improving sustainability literacy of all age groups via all the available modalities (Whether formal, informal and/or non-formal, or any other combination). However formal avenues of sustainability education have received much more scholarly attention compared to informal and non-formal ones.

2.3.4 Sustainability Literacy in Construction

According to Murray & Cotgrave (2007), construction professionals associations have been seen to encourage sustainability literacy. This has largely been through continuous professional development (CPD) programmes and incorporation of sustainability issues in degree courses. According to Schweber (2013), in lieu of formal sustainability education, some professionals adopt standard sustainability approaches such as Building Research Establishment Environmental Assessment Method (BREEAM) and/or engage sustainability specialists. According to Gleeson & Thomson (2012), promotion of sustainability literacy involves a combination of developing required skills and knowledge as well as changing practitioners'

mind-set and culture. Higham & Thomson (2015) argue that formal learning is insufficient to stimulate desired sustainability literacy levels. As such, from the above it is clear that the other available modalities of learning sustainability namely: informal and non-formal, should be explored in efforts geared toward a sustainable construction industry.

As advocated for by Gleeson & Thomson (2012), there are many avenues available to improve sustainability literacy in construction. These are collaboration, policies, legislation, formal learning, informal learning and influence of trade and professional bodies. As explained by Sommerville & McCarney (2003), collaboration takes place when large enterprises interact with smaller enterprises to facilitate skills transfer. In this manner, smaller firms with limited sustainable construction capacity can pursue interactions with larger firms with requisite sustainability expertise to facilitate trickling down of sustainability skills. Revell (2007) postulates that appropriate legislation can stimulate an improved uptake of sustainability learning as has been done with health and safety. Additionally, Gleeson & Thomson (2012), call for ratification of existing sustainability policies in a practical manner to encourage increased sustainability literacy.

On formal sustainability learning, Gleeson & Thomson (2012) argue that, as part of core subjects related to construction, curriculum in formal education should incorporate related sustainability concerns. This has the potential of producing graduates with appropriate skills and knowledge to improve sustainability compliance in the construction industry. Informal learning is equally important as discussed in Section 2.3.3 above such as apprenticeship and industrial attachment. According to Gleeson & Thomson (2012), this form of learning is more suitable for those with craft and trade background in construction. This in light of the practical involvement for the numerous construction related crafts and trades. Lastly, Gleeson & Thomson (2012) postulate that trade and professional associations can help industry professionals overcome sustainability resource constraints. This can be through supporting acquisition of sustainability related skills and knowledge. In addition, through cooperation, these associations can act as sustainable construction knowledge hubs.

The various sustainable construction literacy avenues, with their sources, discussed above are as listed in Table 2.1 next page:

Table 2.1: Sustainable Construction Literacy Approaches

Sustainable Construction Learning Channels/Avenues	Source
Construction professionals' associations influence through CPDs and on degree courses	Murray & Cotgrave (2007)
Construction trade associations influence	Gleeson & Thomson (2012)
Adopting standard sustainability approaches such as BREEAM	Schweber (2013)
Formal learning (Incorporation in formal curriculum)	Murray & Cotgrave (2007), Gleeson & Thomson (2012) and Higham & Thomson (2015)
Informal learning (For those with craft and trade background) such as apprenticeship and industrial attachment	Gleeson & Thomson (2012)
Legislation	Revell (2007)
Policies	Gleeson & Thomson (2012)
Collaboration amongst firms	Sommerville & McCarney (2003)

Source: Author (2018)

2.4 Sustainability Transition in the Construction Industry

2.4.1 Social-Technical Systems and Transitions – The Case for Sustainable Construction

As implied in Section 2.3.1 above, efforts towards improved sustainability compliance, sustainability transitions, in the construction industry involve a socio-technical transformation. European Environment Information and Observation Network (EIONET) (2016), defines socio-technical systems as complex inter-linkages and co-evolution of societal systems and technology. It is these inter-linkages that define the way in which a given society meets its needs. According to Geels (2004), Markard (2011) and Weber (2003), such systems have been known to be made of a network of stakeholders such as firms, individuals and collective stakeholders and institutions which define the applicable society norms, technical standards, regulations and practice standards. Additionally, critical to these types of systems is applicable knowledge and tools. EIONET (2016) argue that as a result of these inter-linkages, such systems are more susceptible to incremental change as opposed to radical change which

sustainability transitions require. This clearly outlines the main challenge which face implementation of sustainability transitions and more so in the construction industry.

Badham et al. (2000) identifies five key features of socio-technical systems. To begin with, they are characterized as having interdependent parts. They are made of more than two elements that are dependent on each other. Examples of these parts are people, technology and environment. Secondly, these systems have been identified to be adaptive while pursuing goals. They are expected to be able to respond to environmental changes and at the same time working towards the intended end results. Thirdly, socio-technical systems have been known to have key internal influence factors as social and technical sub-systems. The social sub-system is made up of people, groups and institutions while technical sub-system is made up of structure of organization and process aspects. The fourth feature is that they have equifinality. This means that the desired end results of the system can be met in more than one way calling for choice during system set-up. Lastly, social and technical subsystems are meant to operate optimally for the general well-functioning of any given socio-technical system.

According to Geels & Schot (2007), socio-technical transitions are fundamental changes in social sub-system (people, groups and institutions) and technical sub-system (structure of organization and process aspects) – a paradigm shift. Markard et al. (2012) argue that such changes involve a wide range of stakeholders (Individual, firms/companies and institutions) and take a long period of time, typically 50 years or more. Such transitions are known to result in new products, services, organization models and approaches. A successful transition involves changes in technical and social sub-systems and at the same time change in criteria in which end-users judge products and/or services which are the end products of the socio-technical systems. According to Ulli-Beer (2013), sustainability transition encompasses the three dimensions of sustainability: economic, environmental and social aspects.

Sustainability transitions have been identified to possess some unique characteristics differentiating them from other transitions. To begin with, these socio-technical transitions are purposeful endeavours geared towards a common good of sustainability (Smith et al., 2005). Sustainability efforts are aimed at finding a lasting and beneficial solution to economic, environmental and social problems facing the society. Secondly, sustainability transitions are associated with a greater collective good, sustainability, as opposed to largely individual stakeholder benefits (Geels, 2011). As such, resistance is almost expected when effecting the

transitions given the tendency of stakeholders to focus more on individual benefits as opposed to collective gain. Lastly, sustainability transitions are multi-dimensional involving complex interactions of public opinion, economics, power and technology (Geels, 2011 and Unruh, 2000). In summary, such transitions can be said to be purposive, of a wider perspective and multi-dimensional in nature.

Construction industry has been identified as key to drive the sustainability agenda. According to Opuku & Fortune (2013), this is based on its widely acknowledged impacts to the environment, social set-up and the economy (See Section 2.3). Sustainable construction practices are geared towards ensuring built environment is in harmony with the natural environment, enhancing quality of life and economic equity (Du Plessis, 2002). The uptake of sustainable construction practices has been advanced to realise gains such as reduced energy use, reduced operational costs, enhanced well-being of the built facilities users, reducing negative environmental impacts and enhanced returns to investors in the built environment amongst other drivers (Zhou & Lowe, 2003 and Hakkinen & Belloni, 2011). In addition, it has been advanced that the uptake of sustainable construction practices is influenced by factors both within and beyond the control of construction industry practitioners (Yoon & Tello, 2009 and Newman, 2009). These enablers and inhibitors are discussed in subsequent sections.

2.4.2 Sustainability Transitions

According to EIONET (2016), socio-economic and environmental challenges facing the world have been identified as complex matters to manage and solve. This has led to calls for action, towards improved sustainability compliance, which have been termed as sustainability transition. Economic, environmental and social dimensions of sustainability have complex inter-linkages. As such, changes in any one dimension will result in gains and/or loses in one or more dimensions. This further complicates efforts geared towards improved sustainability. The change required is usually at multiple scales ranging from sustainability compliant products to global sustainability agendas. Such transitions being unprecedented, as to their execution, are consequently complicated and uncertain processes. Their success requires a combination of learning (formal, informal and/or non-formal), experimentation and collaboration in a bid to share improvement ideas.

Markard et al. (2012) define sustainability transition as multi-faceted, long term change of established social-technical set-ups to comparatively sustainable consumption and production modalities. According to Kemp & Lente (2011), such transitions have a dual nature. They involve a change in socio-technical systems and the same time changing the criteria with which the various stakeholders judge products, services and systems. Any successful transition, including that of sustainability, should aim at achieving the dual objective. Linstone (1999) argue that such initiatives take time for successful implementation and face a fundamental challenge. Typically, the general population, including firms, have their main focus on short term goals complicating efforts by policymakers in rolling out long term sustainability initiatives. Farla et al. (2012) notes that a review of past literature on sustainability transitions points towards a system approach.

According to Farla et al. (2012), there are many stakeholders in successful sustainability transitions. One group of the key stakeholders are policymakers and public authorities. These actors have been identified to sponsor innovations, sustainable technologies and creating supporting institutional framework for sustainability endeavours in a nation (Musiolik et al., 2012; Quitzau et al., 2012 and Bakker et al., 2012). The second group of key stakeholders in sustainability transitions consist of firms/companies. Their role involves engaging in innovation and creating a sustainability supportive environment. Lastly, according to Farla et al. (2012), the other key stakeholders are social movements, civil society, consumers, experts, research organizations and individual stakeholders.

Lastly, in the quest to execute sustainability transitions, there are several strategies and resources employed. One of the strategies as advocated for by Farla et al. (2012), is actors pursuing sustainability matters alone and/or forming alliances to do so. The second strategy is one that focuses on all or part of the above identified stakeholders. The strategies employed by firms target technical capabilities, corporate identity, beliefs and value systems, regulations and policies (Penna & Geels, 2012). On the resources engaged, as advocated by Farla et al. (2012), these include – knowledge, status, political willingness and finances for individuals and organizations. Additionally, supporting institutional structures add to the list of key resources to sustainability transition endeavours. Farla et al. (2012) advocates for engagement of stakeholders (formally and informally) and credible expectations in executing sustainability transitions (given the involved potential resistance) to ensure success.

2.4.3 Factors Promoting Sustainability Transition – Drivers/Enablers

The uptake of sustainable construction practices is propelled by many factors. There is need to simplify them to a small set as advocated for by some construction industry stakeholders (Elmualim, et al., 2012). Basu & Palazzo (2008) categorizes drivers into three different groups: performance, stakeholder and motivation drivers. Performance drivers cover economic, environmental and social pursuits with the aim of boosting the results of a business. A sustainability strategy should enhance the business strategy leading to a better competitive advantage. Stakeholder drivers entail pursuits by a business entity to meet the demands of the stakeholder parties. According to Fairfield et al. (2011), the aim is to gain stakeholders legitimacy by avoiding actions that lead to non-compliance and tarnishing of the business image.

Lastly, motivation drivers cover all the other internal and external enablers for the pursuit of sustainable practices apart from the ones covered in the performance and stakeholder drivers. Fairfield et al. (2011) postulates that these drivers do not operate on their own but rather support the two drivers above described. These drivers are geared towards avoiding penalties, enhancing business reputation and adopting good ethics (Basu & Palazzo, 2008). Wirtenberg et al. (2007) – in a study of most sustainable companies globally – outlines 7 key enablers towards achieving the three-pronged sustainability agenda (environmental, economic and social). These are commitment by top management, centrality of efforts, values consistent sustainability, metrics/measurements, aligning formal and informal organization systems towards sustainability, stakeholder engagement and holistic integration across functions.

Elmualim, et al. (2012) adds legislation, corporate image, organizational ethos, senior management guidance, pressure from clients, lifecycle cost reduction, pressure from employees and pressure from shareholders to the list of sustainable construction enablers. Manoliadis & Tsolas (2006) adds to the list energy and waste management, desire for enhanced indoor environment, environment considerate technologies, appropriate resource use, incentives, standards, regulations and policies, training, re-configuration of the design process, sustainability conscious construction materials, new cost metrics, innovative partnerships, stakeholders, innovative products and enhancing productivity of building assets. The categorization of the identified drivers, including their sources, is as outlined in Table 2.2 next page:

Table 2.2: Sustainability Drivers Categorization

Driver Categories	Sources
A. Stakeholder Related Drivers	
1. Pressure from clients	Basu & Palazzo (2008), Fairfield et al. (2011), Elmualim, et al. (2012) and Manoliadis & Tsolas (2006)
2. Pressure from employees	Basu & Palazzo (2008), Fairfield et al. (2011), Elmualim, et al. (2012) and Manoliadis & Tsolas (2006)
3. Pressure from other stakeholders	Basu & Palazzo (2008), Fairfield et al. (2011), Elmualim, et al. (2012) and Manoliadis & Tsolas (2006)
4. Legislation	Elmualim, et al. (2012) and Manoliadis & Tsolas (2006)
5. Enhanced indoor environment	Manoliadis & Tsolas (2006)
B. Organizational Related Drivers	
1. Corporate image	Wirtenberg et al. (2007) and Elmualim, et al. (2012)
2. Organization ethos	Wirtenberg et al. (2007) and Elmualim, et al. (2012)
3. Alignment of organization (formal and informal) towards sustainability	Wirtenberg et al. (2007)
4. Design process re-engineering	Manoliadis & Tsolas (2006)
C. Management Related Drivers	
1. Commitment of management	Wirtenberg et al. (2007) and Elmualim, et al. (2012)
2. Centralization/integration of efforts towards sustainability	Wirtenberg et al. (2007)
3. Training	Manoliadis & Tsolas (2006)
D. Economic Related Drivers	
1. Boosting business performance	Basu & Palazzo (2008) and Fairfield et al. (2011)

2. Lifecycle cost reduction	Elmualim, et al. (2012) and Manoliadis & Tsolas (2006)
3. Avoiding sustainability related penalties	Fairfield et al. (2011)
4. Enhancing productivity of built assets	Manoliadis & Tsolas (2006)
5. Innovative products	Manoliadis & Tsolas (2006)
6. Appropriate incentives	Manoliadis & Tsolas (2006)

Source: Author (2018)

2.4.4 Factors Impeding Sustainability Transition - Barriers

Sustainability pursuits in the construction industry face numerous barriers. Du Plessis (2002) outlines lack of capacity, uncertain economic environment, poverty and low urban development, lack of accurate data, lack of interest, unavailability of new technologies and uncoordinated research as the inhibitors to sustainable construction in developing countries. More barriers according to Zhou & Lowe (2003) and Williams & Dair (2007) include failure to understand associated benefits, perceived cost implications, lack of interest, lack of stakeholder's commitment to sustainability, inadequate sustainability expertise, unavailability of information on sustainability and unavailability of sustainable construction materials.

Powmya & Abidin (2014) in a study of Oman identified the following groups of challenges to sustainability: economic, professional, society and technology related challenges. Economic challenges cover extra cost and increased project time. Professional/capacity challenges cover lack of materials and technologies knowledge, limited availability of sustainable materials and information, lack of evaluation tools, lack of appropriate building codes and regulations and lack of capacity by involved professionals. Society challenges entail lack of incentives, resistance to change and limited awareness. Lastly, technology challenges consist of issues such as uncertainty of sustainability technology performance, failure to understand how sustainable technology works and inadequate technology specifications on sustainable approaches.

In a study of barriers to sustainable construction in Ghana, Djokoto et al. (2014) identified four categories of barriers namely: cultural, financial, capacity/professional and steering. Cultural barriers consisted of lack of public awareness, resistance to change and lack of demand. Financial barriers are postulated to entail lack of incentives and possible investments increased

cost. Capacity/professional barriers in this study covered lack of design team, lack of sustainability expertise, professional knowledge, information and technology, increased documentation, longer planning, lack of training and cooperation between design and construction teams. Lastly steering concerns entailed lack of government support and evaluation tools. The categorization of the identified barriers, including their sources, is as outlined in Table 2.3 below:

Table 2.3: Sustainability Barriers Categorization

Barriers Categories	**Sources**
A. Economic Related Barriers	
1. Increased project cost	Zhou & Lowe (2003), Williams & Dair (2007), Powmya & Abidin (2014) and Djokoto et al., (2014)
2. Increased project duration	Powmya & Abidin (2014)
3. Uncertain economic environment	Du Plessis (2002)
4. Poverty and low urban development	Du Plessis (2002)
5. Lack of government support	Djokoto et al., (2014)
B. Professional/Capacity Related Barriers	
1. Lack of appropriate knowledge/information	Du Plessis (2002), Zhou & Lowe (2003), Williams & Dair (2007), Powmya & Abidin (2014) and Djokoto et al., (2014)
2. Lack of sustainable construction materials	Zhou & Lowe (2003), Williams & Dair (2007) and Powmya & Abidin (2014)
3. Lack of appropriate sustainability evaluation tools	Powmya & Abidin (2014) and Djokoto et al., (2014)
4. Lack of appropriate building codes and regulations	Powmya & Abidin (2014)
5. Lack of appropriate professional expertise	Powmya & Abidin (2014), Zhou & Lowe (2003), Williams & Dair (2007) and Djokoto et al., (2014)
6. Inefficient coordination between design and construction teams and lack of design team	Djokoto et al., (2014)

C. Societal/Cultural Related Barriers	
1. Lack of interest	Du Plessis (2002), Zhou & Lowe (2003) and Williams & Dair (2007)
2. Lack of incentives	Powmya & Abidin (2014) and Djokoto et al., (2014)
3. Resistance to change	Powmya & Abidin (2014) and Djokoto et al., (2014)
4. Limited awareness	Powmya & Abidin (2014) and Djokoto et al., (2014)
5. Lack of demand	Djokoto et al., (2014)
D. Technology Related Barriers	
1. Uncertainty over sustainability technology performance	Powmya & Abidin (2014)
2. Failure to understand sustainable technology work	Powmya & Abidin (2014)
3. Inadequate technology specifications on sustainable approaches	Powmya & Abidin (2014)
4. Unavailability of appropriate sustainable technologies	Du Plessis (2002) and Djokoto et al., (2014)

Source: Author (2018)

2.5 Sustainability Assessment in the Construction Industry

2.5.1 An Overview – Definition, Purpose and Principles

According to Waas et al. (2014), many definitions exist on sustainability assessment (SA) owing to the wide range of sustainability assessment practices. However, this study adopts a definition drawn from multiple definitions as postulated by Waas et al. (2014): Sustainability assessment is defined as any process geared at advancing understanding, contextualization and influencing uptake of sustainability to steer associated decision making towards managing sustainability (economic, environmental and social) problems and issues. This definition has been confirmed to allow interchangeability of the term's sustainability assessment and sustainability evaluation.

Sustainability assessment endeavours have been identified to serve many purposes. According to Waas et al. (2014), firstly, such assessments generate information required for appropriate decision making. This ensures that decisions are objective by taking into consideration the possible sustainability impacts. Secondly, the assessments encourage stakeholder participation. They provide forums and guidelines for stakeholder engagement in sustainability related decision making. Thirdly, sustainability assessments facilitate paradigm shifts as to the attitudes, views and knowledge of stakeholders (Nooteboom, 2007). These stakeholder engagements provide forums for acquisition of new knowledge and adoption of new perspectives on matters sustainability decision making (Bell & Morse, 2008). Lastly, the assessments provide a framework for structuring the information required for sustainability decision making. This is owing to the fact that sustainability issues are complex and as such require information which is multi-dimensional in nature and thus a challenge to structure. Sustainability assessment frameworks provide guides as to how to structure the information in a usable manner (Waas et al., 2014).

There are key principles, developed over time, on which methods aimed at assessing sustainability should draw from to ensure comprehensiveness. According to Waas et al. (2014), the current applicable framework is the Sustainability Assessment and Measurement Principles (known as Bellagio STAMP). This is a refined framework from the initial guide - "Bellagio Principles - Guidelines for Practical Assessment of Progress toward Sustainable Development". According to Pinter (2009), the first principle is that such assessments should aim at guaranteeing intra-generational and inter-generational equity in context of earth's limited resources. The second principle outlines that the assessments should adopt a systems perspective (Incorporating economic, environmental and social aspects). Thirdly, the assessments scope should cover time aspects (short and long-term) and geographical aspects (locally and globally). The fourth principle requires an objective framework based on key indicators that allows comparability with targets and benchmarks. The fifth underlying principle requires transparency on data, indicators, results, funding and conflict of interest if any. The sixth principle requires assessment methods to ensure effective communication of assessment outcomes. To ensure legitimacy and relevance, the seventh principle calls for stakeholder involvement. Lastly, adopted methodologies should allow repeatability, adapting to change, continuous improvement and development of requisite capacity.

2.5.2 Sustainability Standards and Tools/Methods of Assessment

Internationally, standards on sustainable construction exist as provided by ISO (International Standards Organization) and EN (European Standards). These international standards, through a Vienna agreement, have a common approach on sustainable construction. ISO sustainable construction standards are embodied in ISO 15392, ISO 21929-1, ISO 21930 and ISO 21931-1 documents. On the other hand, EN sustainable construction standards are embodied in EN 15643-1, EN 15643-2, EN 15643-3, EN 15643-4 and EN 15804 documents. They both provide frameworks, by availing established indicators, for assessment of sustainability in the built environment. For example, ISO standards provide for indicators of environmental sustainability to be emissions to air, use of non-renewable resources, fresh water use, waste generation and change in use of land: economic indicators are provided to be ease of adapting, ease of servicing, costs and ease of maintenance: lastly socio-cultural indicators are outlined as services access, ease of access, quality of air and indoor environment, quality of aesthetics and safety (Lylykangas, 2016).

In addition, on a localized scale, sustainability indicators are drawn from the adopted Building Sustainability Assessment methods (BSAMs). According to Markelj et al. (2014), BSAMs in construction are increasingly being used in both public and private projects and in some cases are compulsory. This is geared towards ensuring sustainability is considered, there is transparency and to ensure efficiency in investments. BSAMs in construction, based on scope, can be grouped into three namely: performance-based design, integrated life cycle analysis and rating and certification systems. Performance based design sustainability assessment method covers products, services and processes towards a required outcome such as EcoProp® of Finland and VTT ProP®. This approach involves setting the required performance requirements, establishing methods to achieve the desired performance requirements and measures to ensure the performance requirements are met. The integrated life cycle analysis method covers procurement, erection, use and operation, repair and maintenance, rehabilitation/modernization, demolition/dismantling and reuse/recycling of the products of the built environment. Tools available in this group include: Lifecycle Assessment (LCA) House of Finland, Building for Environmental and Economic Sustainability (BEES) of US and Environmental Impact Estimating Software (ENVEST) of UK. Lastly, rating and certification systems method focus on encouraging sustainability through the lifecycle of constructed facilities though a better integration of sustainability dimensions (environmental, economic and

social) with traditional considerations such as BREEAM from the UK and Leadership in Energy and Environmental Design (LEED) from the USA (Bragança et al., 2010).

There exist specific tools (Sustainability assessment frameworks) that define the sustainability indicators of three sustainability dimensions (economic, environmental and social) as identified in Section 2.3.1. Economic dimension of sustainability indicators, in construction, are aimed at ascertaining whether or not (including extent) a construction project is economically efficient and effective regarding the product (constructed facilities) and associated processes such as construction activities. The applicable tools, as identified in Sustainable Building Information System (SBIS) (2008) in this dimension include, but are not limited to – Cost Reference Model (Netherlands), Lifecycle (UK), GaBi3 (Germany) and Building Life Cycle Cost Program (BLCC), Quick Building Life Cycle Cost Program (QuickBLCC) and Life Cycle Cost in Design Program (LCCID) (USA). For the environmental dimension indicators, they are aimed at ascertaining whether or not (Including extent) the impacts of a construction endeavor and associated support activities degrade the natural environment set-up. The applicable tools, as identified in SBIS (2008) in this dimension include, but are not limited to – Green Building Assessment Tool (GBTool) (International), LEED & Sustainable Project Rating Tool (SpiRiT) (USA), Lifecycle simulation tool providing quantitative indicators of environmental quality (Equer) (France), BREEAM (UK), OGIP (Switzerland) and Hong Kong Building Environmental Assessment Method (H-K Beam) (Hong Kong). Lastly, social dimension of sustainability indicators, in construction, are aimed at ascertaining whether or not (Including extent) the construction endeavours (Including support activities) are considerate of the impacts to all stakeholders. The applicable tools, as identified in Barrow (1997) in this dimension include, but are not limited to – social surveys, questionnaires, interviews and statistics such as census data, social-cost benefit analysis, marketing information and field research. The above discussed sustainability standards and assessment tools/methods in the economic, environmental and social dimensions, including the various sources, are as listed in Table 2.4 below:

Table 2.4: Sustainability Assessment Standards and Tools Categorization

Sustainability Assessment Standards & Tools Categorization
A. Sustainability Standards (Lylykangas, 2016)
1. ISO Standards (ISO 15392, ISO 21929-1, ISO 21930 and ISO 21931-1 documents)

2. EN Standards (EN 15643-1, EN 15643-2, EN 15643-3, EN 15643-4 and EN 15804 documents)		
B. Sustainability (Economic, Environmental and Social) Assessment Tools/Methods		
B1. Economic Dimension Assessment Tools/Methods (SBIS, 2008)	**B2. Environmental Dimension Assessment Tools/Methods (SBIS, 2008)**	**B3. Social Dimension Assessment Tools/Methods (Barrow, 1997)**
1. Cost Reference Model (Netherlands)	1. GBTool (International)	1. Social surveys
2. Lifecycle (UK)	2. LEED (USA)	2. Questionnaires
3. GaBi3 (Germany)	3. SpiRiT (USA)	3. Interviews
4. BLCC (USA)	4. Equer (France)	4. Statistics such as census data
5. QuickBLCC (USA)	5. BREEAM (UK)	5. Social-cost benefit analysis
6. LCCID (USA)	6. OGIP (Switzerland)	6. Marketing information
	7. H-K Beam (Hong Kong)	7. Research

Source: Author (2018)

2.5.3 Sustainability Indicators - Definition, Purpose and Principles

Waas et al. (2014) defines an indicator as an operational value of an element in a system as measured by a quantitative or qualitative parameter compared to reference value. A sustainability indicator can consequently be defined as an operational value of sustainability attributes in a system as measured by a quantitative or qualitative parameter compared to reference sustainability value. Braganca et al. (2010) defines sustainability indicators as expressions of value which are a factor of summed variables that are measurable. From the above definitions, it is clear that sustainability indicators:

i. Have operational value;
ii. Are measures of elements in a system;
iii. Are measurable;
iv. Can be expressed quantitatively or qualitatively; and

v. Are compared against some reference values.

This leads to the following integrated definition of a sustainability indicator (SI) by this study:

A sustainability indicator is a measurable operational expression of value for sustainability attributes (Economic, environmental and social) in a system (Socio-technical set-up), expressed qualitatively (Descriptively) and/or quantitatively and is compared to a reference sustainability value.

Braganca et al. (2010) postulate that in construction, these indicators are used to highlight the impact of the entire industry and in other cases that of specific constructed facilities economically, environmentally and socially. Many indicators exist and the numbers can be explained by the differences in regions, societies and industries amongst other things. Du Plessis (2002) emphasizes on the need to capture information on sustainability indicators (SI) as a way of assessing the impact of sustainability approaches. Additionally, capturing this information is postulated to help in troubleshooting future problems and risks. Bragança et al. (2010) postulates that based on indicators, sustainability assessment approaches are used to collect and report on information on which decisions are made over the lifecycle of a construction project. This is through a process of indicators identification, analyzing and valuation to give rise to sustainability scores.

The indicators have been identified as complex and diverse with the general trend being towards simplifying them for ease in application. According to Braganca et al., (2010), these indicators should be appropriate, specific, measurable and transparent. These indicators are drawn from adopted global sustainable construction standards and/or adopted BSAMs. According to Braganca et al. (2010), sustainability indicators for construction projects can be drawn from various lists generated at different levels such as national and sectorial. At a higher level, these indicators are summed up into sub-groups. According to Waas et al. (2014), the resulting aggregated metric is referred to as an index.

Sustainability indicators have been identified to serve some key purposes. According to Waas et al. (2014), firstly, they provide a framework for structuring the information required for sustainability decision making. Secondly, they facilitate translation of sustainability from an

abstract concept to practice. This facilitates practical application of sustainability in the different areas of application by defining practical units of measure (Rigby et al., 2001 and Rigby et al., 2018). Thirdly, as advocated by Nooteboom (2007), they facilitate paradigm shifts as to the attitudes, views and knowledge of stakeholders. Fourthly, they facilitate accountability by outlining sustainability performance in measurable terms which can also allow benchmarking amongst stakeholders (Bebbington et al., 2007; Hodge et al., 1999 and Waas et al., 2014). Lastly, they facilitate identification of areas that require data and/or information in sustainability including how to fill them. This is by highlighting areas with no or less developed sustainability knowledge to facilitate use of indicators and where sustainability data is not available or sufficient (Hodge et al., 1999).

Sustainability indicators have been identified to be developed from either a top-down approach, bottom-up approach or a combination of both. A combination of both approaches has been advocated for by numerous scholars to allow the benefits associated with each approach (Bell & Morse, 2001; Reed et al., 2005 and Reed et al., 2006). There is however no consensus as to best combination of the two approaches (Waas et al., 2014). Top-down approaches have been identified to be expert led and largely quantitative with a scientific approach (Bell &Morse, 2001). They have been observed to fail to involve stakeholder engagement in arriving at such approaches (Reed et al., 2006). On the other hand, bottom-up approaches are built by the involved stakeholders are largely qualitative and lack a detailed application guide compared to top-down approaches (Bell & Morse, 2001 and Reed et al., 2006). Persson (2011) postulate that the choice of sustainability indicators in any situation should be considerate of the intention of assessment and stakeholders' interests.

2.5.4 Construction Projects Sustainability Indicators Framework – Towards Developing a Sustainability Assessment Framework Applicable to Kenya

Persson (2009) postulate that despite the existence of numerous standards and tools (As identified in Section 2.5.2) that guide assessment of sustainability in construction, it is complex to compare them. As such, any assessment framework to be adopted should be objective, context-specific and should factor in the three dimensions of sustainability (Economic, environmental and social). These assessment methods have been observed to largely focus on economic and environmental dimensions of sustainability (Isa, 2015 and Persson, 2009). In Kenya, it is important to note that no BSAM (Incorporating the three sustainability dimensions)

has been developed or suitably adapted nor has there been an international standard on sustainability that has been adapted for local application. Considering the numerous sustainability standards and assessment tools, there is need for a simplified assessment framework for application in construction projects.

This study, adopts the sustainability indicators as identified by the integrated framework developed by Markelj et al. (2014) after a review of numerous sustainability standards and BSAMs. The BSAMs considered in this review were BREEAM, LEED, The German Sustainable Building Council assessment methods of the assessment system for sustainable building (DGNB/BNB), High Environmental Quality (HQE), Japanese methodology for computing building environmental efficiency (CASBEE), Total Quality Building (TQB), Baseline Environmental Assessments (BEAS), International Sustainable Building Tool (SBTool), Project for common European assessment methodology for sustainable buildings based on European standards (OPEN HOUSE) and Project for facilitating training on planning and construction of energy saving and producing buildings in the Alpine space (ENERBUILD). The international sustainability standards considered in the integrative framework are EN 15643 and ISO 21929-1. This study adopts the identified sustainability indicators to draw from the expertise involved in developing the individual involved standards and assessment tools while at the same time minimizing individual weakness of any specific standard or assessment tool. There exist tools, amongst other means, of quantitatively and/or qualitatively measuring the identified criteria/core indicators in a given construction project. Table 2.5a, 2.5b and 2.5c below presents a simplified sustainability assessment framework, for the three dimensions of sustainability, as adapted from Markelj et al. (2014):

Table 2.5a: Sustainability Assessment Framework – Economic Indicators Outline

Sustainability Aspect	**Aspect Categories**	**Aspect Core Indicators (To be Scored)**
Economic aspect	**i. Costs**	1. Construction costs
		2. Operational costs
		3. Maintenance & renovation costs
	ii. Property value	4. Marketability
		5. Art on site
		6. Outdoor plan
		7. Location

Source: Adapted from Markelj et al. (2014)

Table 2.5b: Sustainability Assessment Framework – Environmental Indicators Outline

Sustainability Aspect	Aspect Categories	Aspect Core Indicators (To be Scored)
Environmental aspect	**i. Pollution and waste**	1. Environmental footprint
		2. Waste minimization and separation
	ii. Energy	3. Heating/cooling energy demand
		4. Primary energy demand
		5. Energy use monitoring
	iii. Water use	6. Mains water use
		7. Rainwater and grey water use
	iv. Materials	8. Responsible sourcing
		9. Local sourcing
		10. Recycling potential
	v. Land use	11. Sensitive land protection
		12. Ecological features protection
		13. Outdoor micro-climate effect
		14. Light pollution

Source: Adapted from Markelj et al. (2014)

Table 2.5c: Sustainability Assessment Framework – Social Indicators Outline

Sustainability Aspect	Aspect Categories	Aspect Core Indicators (To be Scored)
Social aspect	**i. Wellbeing**	1. Thermal comfort
		2. Visual comfort
		3. Acoustic comfort
		4. Ventilation
		5. User control
		6. Safety and security
	ii. Functionality	7. Accessibility for disabled
		8. Layout adaptability
		9. Ease of maintenance
		10. Fire security

	iii. Technical features	11. Noise protection
		12. Seismic safety

Source: Adapted from Markelj et al. (2014)

The combined indicator scores for the three sustainability dimensions as identified in Tables 2.5a, 2.5b and 2.5c give the overall sustainable construction score. Additionally, Tables 2.6a, 2.6b and 2.6c below outlines the meaning of the identified criteria/core indicators as explained by Markelj et al. (2014):

Table 2.6a: Sustainable Construction Core Indicators for the Economic Dimension Explained

Economic Dimension Core Indicators	Short Description
1. Construction costs	A constructed facility should be realized at the minimal practical cost that allows economic returns to the developer (s).
2. Operational costs	The costs incurred during the operation of the constructed facility in context should be within owner's financial capacity. These costs include but are not limited to heating, cooling, ventilation, electricity, water and cleaning costs.
3. Maintenance & renovation costs	The costs incurred during maintenance and renovation of the constructed facility in context should be within owner's financial capacity. These costs include but are not limited to repair, refurbishment and replacement costs.
4. Marketability	The constructed facility in context should be of value expected by the target market and should be able to sustain the value through the period designed for.
5. Art on site	The artistic outlook of the constructed facility should contribute to its value considerate of the context in which the facility is in.
6. Outdoor plan	The spatial distribution of the various constructed facilities on the land in context

	should contribute to its value considerate of the context in which the facility is in.
7. Location	The constructed facility in context should be located proximal to the requisite support infrastructure e.g. a series of flats should be proximal to learning institutions and health facilities amongst other things.

Source: Adapted from Markelj et al. (2014)

Table 2.6b: Sustainable Construction Core Indicators for the Environmental Dimension Explained

Environmental Dimension Core Indicators	**Short Description**
1. Environmental footprint	The constructed facility in context should be considerate of its negative impacts on the natural environment throughout its lifecycle.
2. Waste minimization and separation	To minimize construction waste, recycling should be encouraged and at the same time, resulting waste should be appropriately sorted prior to appropriate disposal.
3. Heating/cooling energy demand	Constructed facilities should use the minimum amount of energy possible for heating and/or heating purposes.
4. Primary energy demand	Constructed facility should use the minimum amount of primary energy with a large partition of the energy required being from renewable sources as opposed to no-renewable sources.
5. Energy use monitoring	There should be means of observing the energy use in a constructed facility with the aim of identifying major variations from the expected levels to allow for appropriate corrective action (s).
6. Mains water use	Used sanitary appliances/fittings should allow for minimal use of water.

7. Rainwater and grey water use	Rain water and grey water should be used, where appropriate, to minimize the water load requirement from the mains water.
8. Responsible sourcing	Materials to be used in a constructed facility should be appropriated verified to be considerate of their impacts on the environment and should not pose a health risk.
9. Local sourcing	Local materials should be prioritized for use in a constructed facility to minimize associated transport costs and at the same improve the local economy by supporting local production.
10. Recycling potential	Recycling of obsolete materials and components of constructed facilities should be encouraged to minimize the demand on new materials and components which increases the load on to the natural environment.
11. Sensitive land protection	When citing the location of constructed facilities, one should avoid land with high agricultural potential and underdeveloped land such as forests.
12. Ecological features protection	Any construction related development should take record of the local ecological set-up and should protect loyal flora and fauna as much as possible.
13. Outdoor micro-climate effect	The resulting constructed facility should have minimal impact on the micro-climate around it.
14. Light pollution	Lighting used to illuminate in and around constructed facilities should be appropriate.

Source: Adapted from Markelj et al. (2014)

Table 2.6c: Sustainable Construction Core Indicators for the Social Dimension Explained

Social Dimension Core Indicators	Short Description
1. Thermal comfort	A constructed facility should have an interior with temperatures with the limits of human comfort throughout the year.
2. Visual comfort	A constructed facility should have an exterior and interior that is pleasing to look at.
3. Acoustic comfort	Appropriate acoustic properties should be allowed for in the spaces of a constructed facility for user comfort when using the spaces.
4. Ventilation	Spaces in a constructed facility should be appropriately ventilated to user comfort levels.
5. User control	Users of a constructed should be able to regulate the various aspects of the facilities such as sun shading, lighting, temperature and ventilation.
6. Safety and security	Design of a constructed facilities including fitted furniture, fixtures and equipment should minimize user injuries and potential criminal acts.
7. Accessibility for disabled	A constructed facility should have relevant provisions to allow accessibility by physically disabled persons.
8. Layout adaptability	The building plan adopted should be flexible and allow any potential user adjustments as and when necessary.
9. Ease of maintenance	Parts and components of a constructed facility should be easy to maintain and/or replace.
10. Fire security	Appropriate fire security provisions should be allowed for in a constructed facility. These include but are not limited to fire detectors, sprinkler systems and fire alarms.

11. Noise protection	Noise levels (both from outside and inside a constructed facility) should be within levels suitable for the use of the various spaces.
12. Seismic safety	A constructed facility should have appropriate earthquake resistance capabilities to reduce danger and damage during an earthquake.

Source: Adapted from Markelj et al. (2014)

Markelj et al. (2014) advocates for weighting of the core indicators/parameters to determine the importance attached to each core indicator in a given specific local context. This is meant to ensure that the assessment framework adopted suits the specific local environment under consideration.

2.6 Sustainable Construction Compliance in the Construction Industry

There has been increased recognition regarding the need for integration of sustainable development practices in construction practices especially in developing countries (Gunatilake, 2013 and Abdelhamid, 2013). According to Ochieng at al. (2014), integration of sustainable practices is important to ensure construction projects are sustainability compliant as this will improve delivery of construction projects. This necessitates considerations on many project aspects such as building materials, construction practices and stakeholders' commitment. The incorporation of sustainability practices in construction is hindered by multiple barriers (See Section 2.4.4). These barriers necessitate intentional courses of action towards sustainable construction practices (Isa et al., 2014). According to Griffiths (2007), sustainability frameworks guide this integration through fostering commitment, having a sustainability criterion for design, construction, sustainability project systems, creating a sustainability culture, linking sustainability to performance, reporting project performance, stakeholder involvement and the appropriate choice of a project delivery model.

Fostering commitment is geared towards making the management and project leaders to be conscious of sustainability considerations. The leader develops the framework and works with the project team to identify related issues, then acts and monitors progress. There is also the need to ensure that project design includes sustainability concerns (economic, environmental and social). This calls for a design team that is conversant with the relevant sustainability

issues. During construction, sustainability frameworks guide the execution of construction activities to ensure they are sustainability conscious. This phase is largely focussed on a construction team that aligns itself with design considerations made on the basis of sustainability.

Sustainability project systems are geared towards ensuring that sustainability concerns in design are carried through to the construction stage. This is normally done through adoption of sustainability conscious policies, plans, tendering process, instructions, training, performance management and communication to stakeholders. Entrenching a sustainability culture in the entire project team is key in the integration of sustainability in construction practices. This may be done through raising sustainability awareness levels and fostering a paradigm shift towards sustainable construction both at strategic and operation levels. Adopted project delivery models should encourage a collaborating multi-disciplinary project team working towards project solutions that focus on sustainability. It however cannot be over-emphasized that it is crucial to involve stakeholders. This helps smoothen working relationships and enhances reputation of a construction project team (Griffiths, 2007).

Griffiths (2007) associates sustainability integration frameworks in infrastructure projects with multiple gains. These include action towards sustainability responsibility, coverage of the numerous project aspects, facilitating stakeholder's approval, efficient lifecycle operation costs, potential recognition for efforts towards sustainable construction, potential opportunities of promotion of the work being done and the ability to assess the project specific progress made in regards to sustainability.

2.7 Conceptual Framework – Way Forward

With sustainability being a global agenda, there is no doubt as to the call for action to all industries and construction industry is not exempted. The construction industry potential to adopt and enhance sustainability is implied in its own known economic, environmental and social impacts as identified in Section 1.2. The starting point is by incorporating sustainability (economic, environmental and social) considerations in construction projects through the key construction professionals. These professionals include but are not limited to architects, interior designers, quantity surveyors, mechanical engineers, electrical engineers and contractors.

These considerations are partly supposed to inform sustainability literacy drives. These drives can be in the form of formal learning such as in a degree course; informal learning such as online reading and apprenticeship; collaboration such as partnering with sustainability promoting organizations; policies such as having an organizational sustainability policy; legislation through Acts of parliament; influence of trade and professional associations such as through continuous professional development course or any combination of these approaches. These should be geared at making the key professionals in the construction industry sustainability conscious. It is upon the acquisition of construction sustainability skills and knowledge, via the above identified channels, that the key professionals can be said to be sustainability literate. Sustainability literacy is part and parcel of efforts towards having a sustainability compliant construction industry. In line with sustainability literacy as an independent variable, the study had hypothesized in the alternative that the impact of sustainability literacy on sustainability compliance, in the Kenyan construction industry, was above average.

Firstly, sustainability literate construction industry professionals are better placed at facilitating improved uptake of sustainable construction practices. This improved uptake of sustainable construction approaches can be through individual or group efforts of key construction professionals as identified above. To foster this uptake, the role of stakeholder involvement, whether formal, informal or a combination of both, is key. This is geared towards ensuring that the stakeholders own up sustainability endeavors. Additionally, there is need to leverage the known drivers of sustainability endeavors as identified in Section 2.4.3. At the same time, the stakeholders should suppress the known barriers to adoption of sustainable construction practices as identified in Section 2.4.4. All these approaches are aimed at improving the uptake of sustainable construction practices in construction projects. In line with sustainability transition/uptake as an independent variable, the study had hypothesized in the alternative that the impact of sustainability transition/uptake on sustainability compliance, in the Kenyan construction industry, was above average.

Secondly, sustainability literate construction industry professionals are better placed at facilitating improved and objective sustainability assessment in construction projects. The starting point is by adopting an applicable construction sustainability standard or BSAMs as a guide to the assessment process. This is through use of sustainability indicators of construction projects as identified in the adopted sustainability standard (s) or BSAM (s). The identified

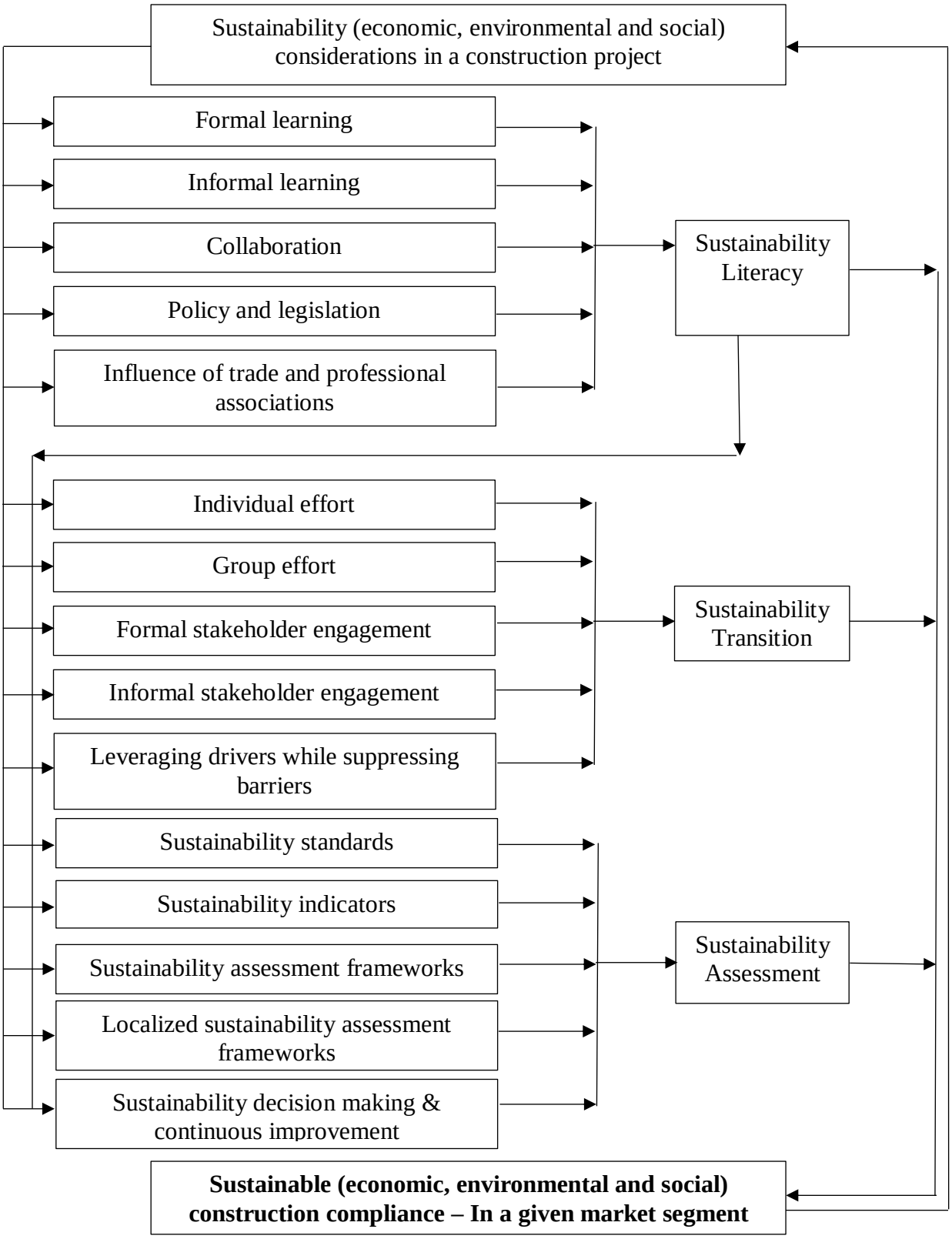
indicators are supposed to guide the development of sustainability assessment framework incorporating the three dimensions of sustainability. To make the framework applicable to given area, geographically, there is need to have the core indicators/criteria weighted as per local industry experts' opinions on the core indicators/criteria. It is the weighted assessment framework outcomes, for a given construction project, that should inform sustainable construction decisions to ensure objectivity. The outcomes should be used as a basis of continuous improvement to the adopted sustainable construction practices. In line with sustainability assessment/evaluation as an independent variable, the study had hypothesized in the alternative that the impact of sustainability assessment/evaluation on sustainability compliance, in the Kenyan construction industry, was above average.

Improved sustainability literacy, in the construction industry, has the potential of improving sustainability uptake and ensuring improved and objective sustainability assessment in construction projects. Consequently, improved uptake of sustainable construction practices and improved and objective sustainability assessment of construction projects have the potential of realizing a comparatively sustainable construction industry. On sustainability compliance as the dependent variable and as postulated by Leedy & Ormrod (2005), the study had a main hypothesis which was to be accepted only and when all the other 3 sub-hypotheses as captured above were accepted. To this regard, this study had hypothesized that the joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainability compliance, in the Kenyan construction industry, was above average.

This study focused on the interior design market segment of the construction industry. This was aimed at developing a segment appropriate approach to improving sustainable construction compliance. As such, peculiarities of the given construction industry market segment were deemed to be a key factor, a moderating variable, in influencing the impact of sustainability literacy, uptake and assessment on sustainable construction compliance. In Webster-Stratton & Reid (2003), though not tested, low socio-economic status had a moderating effect on uptake of parenting interventions and facilitated development of socio-economic status appropriate approaches. This was through engaging, and making the programs accessible to, parents with low socio-economic status. In the same vein, this study did not test the effect of specific construction industry market segment peculiarities on the contribution of sustainability literacy, uptake and assessment on sustainable construction compliance.

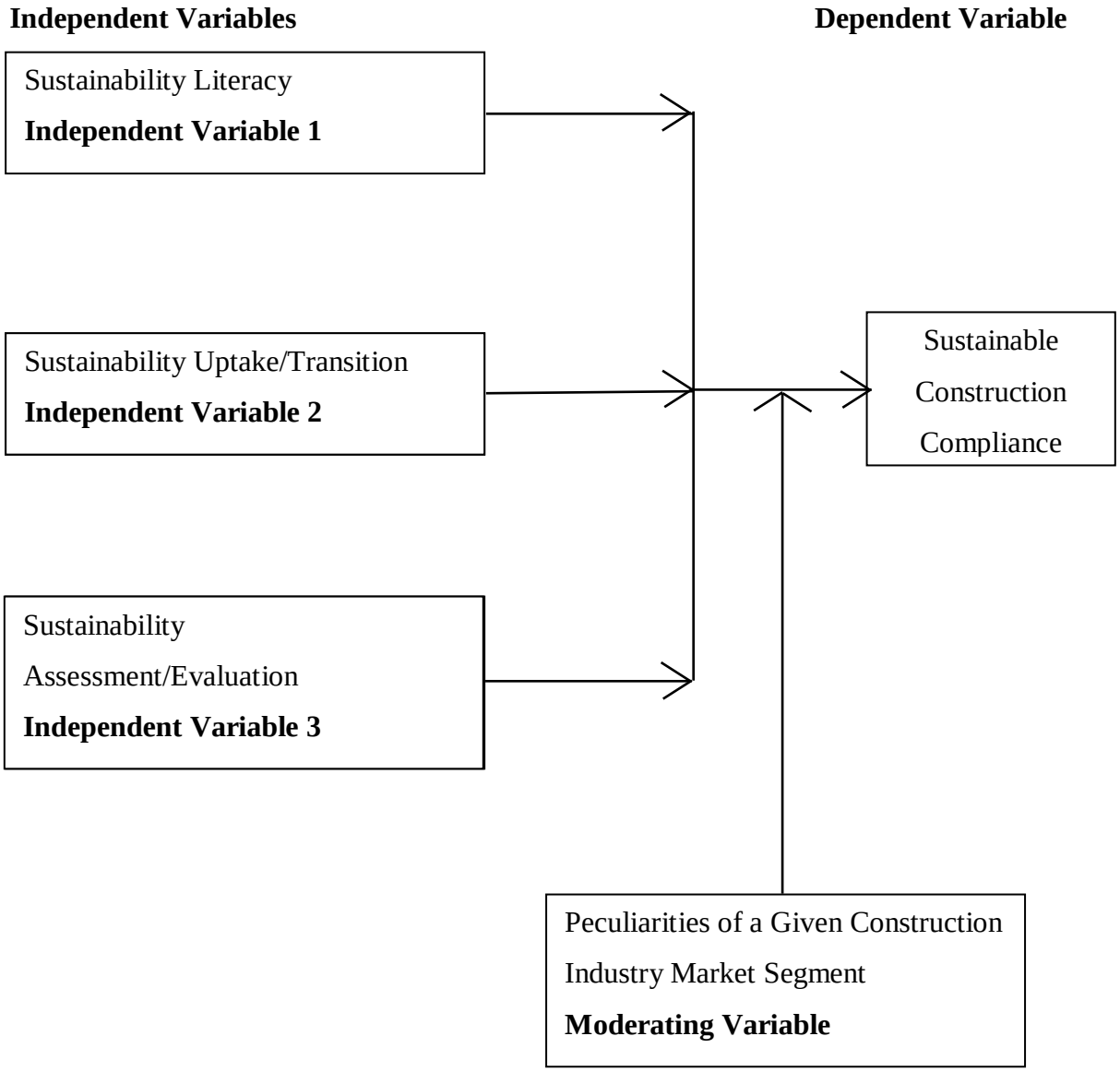
This is summarized in the conceptual frameworks adopted for this study as illustrated in Figures 2.2 and 2.3 below.

Figure 2.2: Conceptual Framework - Way Forward



Source: Author (2018)

Figure 2.3: The Sustainability Variables in Conceptual Framework



Source: Author (2018)

2.8 Conclusion

This chapter discussed interior design and its relation to sustainability. This was firstly through introduction of sustainability in the construction industry and the various avenues available to the industry stakeholders to learn sustainable construction practices. Secondly, nature of transitions towards sustainability compliance were discussed. This included a review of the factors that drive and impede sustainability construction endeavors. Thirdly, the nature of

sustainability assessments and available assessment standards, tools and methods were discussed. Additionally, a discussion as to operational measures of sustainability was offered including a framework to guide assessment of the three dimensions of sustainability in construction projects. The chapter culminated in a framework that guided execution of this study in the subsequent chapters.

Sustainability is geared towards ensuring current generations are able to meet their needs while at the same ensuring that the future generations are able to do the same. The construction industry, in which the interior design projects are found, gives rise to constructed facilities which form the built environment. In developing the built environment, construction industry has been identified to have three broad classes of impacts in relation to sustainability, that is, social, economic and environmental impacts. These impacts have been identified to be comparatively vast in developing countries (See Section 1.2), a category in which Kenya belongs.

In response to these impacts, it has been established that several factors, both within and beyond the control of the construction industry, influence the uptake of sustainability construction practices. Several authors have identified those influencing factors that promote uptake of sustainable construction practices, these are largely referred to as drivers (See Section 2.4.3). On the other hand, other factors exist that impede the uptake of sustainable construction practices and these have been largely referred to as barriers (See Section 2.4.4). These factors in totality are inclined towards the different stakeholders in the construction industry highlighting the ability from within to adopt sustainable construction practices to comparatively larger extent.

Lastly, due to the negative impacts associated with construction practices that are not sustainability compliant, adoption of sustainable construction practices cannot be over-emphasized. Conventional design and construction practices require modification to allow incorporation of sustainability principles. The extent of success or failure of sustainable construction practices is critical in improving efforts towards the sustainability agenda. This assessment is based on agreed set of indicators which can be drawn from international standards or from applicable/adopted Building Sustainability Assessment Methods (BSAMs) (See Section 2.5).

The next chapter presents the research methodology that was adopted by the study to address the pre-set research questions and hypotheses within the confines of related past literature as covered in this chapter.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the procedure, including the associated rationale and assumptions, adopted in studying the research problem. The first section, research design, describes the general approach used to execute this study from inception to completion. This involved identification of the applicable research methods and measurements, qualitative and/or quantitative, and their relation to the study objectives. Secondly, target population, sampling units and sampling frame for the study were defined. Thirdly, sample sizing specifically sample size computation and adjustment for non-response narrative is given. Fourthly, the nature of study data and data collection approaches are discussed. This includes sources of data, methods and instruments of data collection and a summary of research tools employed in the study. Fifthly, a discussion as to the validity and reliability of the research instrument is offered. This includes aspects of validity, internal and external, while for reliability, stability and equivalence aspects are discussed. The sixth section of the chapter describes and explains the unit of analysis and unit of observation and data analysis approaches for Likert data including the data analysis and presentation tools and techniques that were used for this study. The seventh and last section identifies and explains the rules and guidelines that governed the conduct of the researcher and research assistants in course of executing data collection for this study. The chapter concludes with a brief summary of all the discussed issues.

3.2 Research Design

This study employed a quantitative research approach. Quantitative research approaches involve quantitative data collection about the phenomenon in question and the formal and rigid analysis of the collected data (Kothari, 2004). On quantitative research approach, the study ultimately sought to infer population attributes from sample attributes. These attributes were sustainability literacy, uptake/transition and assessment/evaluation as key contributors to sustainability compliance in the construction industry. Sample attributes in this study were established from data collected from the respondents using questionnaires. Kothari (2004) further postulates that questionnaires may use fixed alternative questions and closed-ended questions and/or open-ended questions. The exploration of these perspectives from key interior

design project professionals was done through structured questionnaires using a combination of fixed alternative, closed-ended and open-ended questions. The fixed alternative and closed-ended questions provided quantifiable data on the attributes under study, as above identified, that was consequently converted to usable information through data analysis. On the other hand, the one open-ended question allowed respondents provide first-hand information on why they did not assess sustainable construction where applicable.

For purposes of this study, these key interior design professionals were identified as interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and contractors. These categories of professionals were identified as key since they constitute the typical core team required for planning, design, implementation and post-implementation review of a typical professionally executed interior design project in Kenya as identified in Section 1.1.2. Based on their implied potential to influence the entire project lifecycle, it can be argued that they are key to sustainability compliance in construction projects. The information gathered from the sample of key interior design project professionals, was used to generalize the findings on the larger population which is the Kenyan construction industry within the set limits of sampling error. The study specifically set-out to establish the perspectives of key interior design project professionals on aspects of sustainability literacy, transition and assessment in the construction industry. This was aimed ultimately at drawing inferences about the joint impact of the three independent variables, sustainability literacy, transition and assessment, on sustainable construction compliance in the construction industry with the consequent intention of proposing solutions specific to the Kenyan construction industry context.

3.3 Target Population, Sampling Units and Sampling Frame

According to Kothari (2004), the universe [Population] refers to the total collection of objects of any study in question. This collection can be of a known number, finite, or of an unknown number, infinite. The target population for this study was the key project professionals in the Kenyan construction industry. The sampling units, components of the population, for this study, were interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and contractors in Kenya. This was informed by the fact that these are the key project team members with key contributions to sustainability compliance in construction projects as implied in Section 3.2 above. Lastly, the sampling frame [Source list] was defined as the pool

of interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and contractors from which the sample was selected. The geographical scope of this study was Nairobi City County being the county where the researcher resided during the course of this study. Additionally, the study sampling frame was set to have the sample to be drawn from completed and ongoing interior design projects between the years 2016 to 2018. This ensured that the respondents were currently and actively practicing bearing in mind the limited study time and financial resources. The choice of interior design projects was informed by the limited scholarly coverage of sustainable construction in interior design projects and the fact the researcher practiced in the said market segment of the construction industry.

No data existed to provide a list of such projects and consequently that of key project professionals as identified above. This was partly because interior design projects are difficult to identify given that they are mainly indoors and many lack external project signboards, lack relevant published data and the naming of projects in the list of approved projects by Nairobi City County does not differentiate interior design projects from other construction projects. As postulated by Kothari (2004), where a source list of all components of the population is not available, the researcher can come up with one ensuring it is comprehensive, correct and representative of the population. The researcher engaged practicing interior designers from autonomous interior design firms in Kenya to generate a list of these projects, and only for those with all the five key professionals, since there exists no published data. A total of 60 projects were identified as a result. Out of the 60 only 55 were in Nairobi City County while 5 were from other counties. As such, at that stage, the 5 projects were dropped from the pool since they were outside the geographical confines of the pre-set sampling frame. Secondly, the study sought to ensure that the sampling frame did not have repetition as to the involved professionals. Consequently, the researcher ensured that each of the firms identified was only represented once in the pool of identified projects. This resulted in 10 projects where the five categories of professionals were different with regards to the firms they owned or worked for. As such, the target population as drawn from the 10 projects was 50 key professionals (10 interior designers/architects, 10 electrical engineers, 10 mechanical engineers, 10 quantity surveyors and 10 fit-out contractors).

3.4 Sampling

Kothari (2004) defines sampling as the process of identifying part of a larger group, sample, from which inference about the larger group [population/universe] is made from the analysis of data from the part, about specific parameters, of the larger group. As postulated by Israel (2012), numerous approaches exist as to how a researcher can determine the size of a sample from the population. These approaches include the use of a census for small populations, adopting sample sizes used by similar studies, using published sample size determination tables and using sample size calculation formulae. This study adopted the formula approach as postulated by Yamane (1967) for sample size calculation:

$$n = \frac{N}{1 + N(e)^2}$$

Where:

i. n = Calculated sample size;
ii. N = Target population;
iii. e = Level of precision; and
iv. Assumption = 95% confidence level.

Sample size calculations for the study:

i.	n	=	Calculated sample size	=	Calculated below;
ii.	N	=	Target population	=	50 key professionals;
iii.	e	=	Level of precision;	=	5% (0.05); and
iv.	Assumption	=	95% confidence level	=	As inferred in (iii) above.

Calculated sample size = n = (50) / ((1+50(0.05) ^2))

Calculated sample size = n = 44 respondents

In addition, as postulated by Israel (2012), a 30% addition is usually made to the calculated sample size to compensate for non-response during data collection. As such:

Sample size adjusted for non-response = 130% * n

Where:

i. 130% = 1.30; and

ii. n = Calculated sample size = 44 respondents

Sample size adjusted for non-response = 1.30 * 44 = 57.2 = 57 respondents

The population is heterogeneous in nature with 5 distinct categories of key professionals. To ensure equal representation of each category, the sample size for each category can thus be said to be:

Sample size per category of key professionals = Sample size adjusted for non-response / number of professional categories

Sample size adjusted for non-response = 57 respondents
Number of professional categories = 5 (Interior designers/Architects, electrical engineers, mechanical engineers, quantity surveyors and fit-out contractors)

Sample size per category of key professionals = 57 / 5 = Approximately 12 respondents.

The nature of the sample is as outlined in Table 3.1 below:

Table 3.1: Nature of Sample Size

Key Interior Design Project Professional Category	**Sample Size**
i. Interior designers/Architects	12 respondents
ii. Electrical engineers	12 respondents
iii. Mechanical engineers	12 respondents
iv. Quantity surveyors	12 respondents
v. Fit-out contractors	12 respondents
Total sample size adjusted for non-response	**60 respondents**

Source: Author, 2018

3.5 Nature of Data and Data Collection (Sources, Methods, Instruments and Research Tools)

This study employed both primary and secondary data in a bid to answer the research questions as identified in Section 1.4. Primary data was acquired from first hand sources, key interior design project team professionals (Interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and fit-out contractors). The data was collected using structured questionnaires employing a combination of fixed response, closed-ended and open-ended questions. Secondary data was acquired from books, online resources, journals, research thesis and projects, both published and unpublished, amongst other scholarly sources. This data framed this research in context using past literature on sustainability literacy, transition/uptake and assessment/evaluation in relation to the construction industry. In addition, this past literature also guided data collection and analysis. Collectively, the resulting data was predominantly quantitative in nature.

The process of data collection was in two phases: preparation and execution. For the preparation phase, the researcher sought authorization from the allocated University supervisor and The Department of Real Estate and Construction Management. Additionally, the researcher sought willing research assistants to distribute the questionnaires to the target population. The research assistants were trained by the researcher on how to explain the purpose, intended benefits and beneficiaries of the study including assuring the respondents of anonymity and confidentiality. Additionally, the planning of questionnaire administration time frames was done. The execution phase involved preparation of the questionnaire package which included letters authorizing the research as above sought, questionnaire cover letters and the actual questionnaires. Additionally, this phase involved distribution of questionnaires to the research assistants, distribution and subsequent collection of the questionnaires by the researcher and research assistants from the respondents and checking the completeness of received questionnaires including the exclusion of incomplete ones.

Lastly, regarding data collection instruments, this study employed structured questionnaires with 5 parts. Part 1 covered definitions of key terms used to ensure the respondents understood the main terms used in the study, and part 2 covered the background data of the respondents. This included their typical roles in interior design projects, experience in interior design projects, number of interior design projects that the respondents were handling at the time this

study was conducted and their highest levels of education. Part 3 covered independent variable 1: sustainability literacy in the Kenyan construction industry. This focused on sustainability literacy levels, key sustainability concerns and sustainability literacy avenues in the Kenyan construction industry. Part 4 covered independent variable 2: sustainability transitions in the Kenyan construction industry. This focused on sustainability uptake levels and factors driving and impeding sustainability uptake. Part 5 covered independent variable 3: sustainability assessment in the Kenyan construction industry. This focused on sustainability assessment levels, familiarity with sustainability assessment standards and/or tools, familiarity levels on sustainability indicators and assessment framework (s) that jointly covers the three dimensions of sustainability. Lastly, part 6 covered the dependent variable sustainability compliance in the Kenyan construction industry. This focussed on the effectiveness of sustainability literacy, transition and assessment in promoting sustainable construction compliance in the Kenyan construction industry.

In a nutshell, the researcher employed a number of research tools to collect, manipulate and interpret data to allow for meaningful and beneficial conclusions. One of the used tools was the library as a source of secondary data for this study. Secondly, computer and computer software were used as research tools. For computer, the researcher used the internet to access *p*-value online calculator to compute *p*-values for a given *t*-statistic value. On computer software, the researcher used MS Excel 2013 for descriptive statistics computations. Thirdly, statistics were also used as a research tool. This was partly through descriptive statistics to classify, summarize and explaining data. Additionally, it was through inferential statistics that population attributes were deduced from sample attributes. Fourthly, the study engaged the researchers mind as a research tool through interpretation of the data and resulting analysis of results to arrive at logical conclusions. Fifthly and lastly, measurement was also used a research tool. Specifically, the study employed insubstantial measurements (Intangible) since the data collected was of a perspective nature.

3.6 Evaluation of Research Instruments

The research instrument employed in this study was a structured questionnaire. The validity and reliability aspects of the questionnaire as a research instrument are discussed next page:

3.6.1 Research Instruments Validity

The validity of research instruments is the degree to which they measure what they are intended to measure. A research instrument is said to valid when the differences found by the instrument reflect the differences among the observed variables. There are two main categories of validity, internal validity and external validity. Internal validity is the ability of a research design to measure what it aims to measure. This simply means the extent to which results about dependent variable are attributable to independent variables (Kothari, 2004). Applicable to this study was one specific type of validity namely content validity. Kothari (2004) defines content validity as the measure of adequacy by which a research instrument covers the knowledge area under study. As recommended by Kothari (2004), the researcher engaged 6 professionals in the construction industry, between 1st December 2018 and 5th December 2018, on separate sessions to review how adequately the draft questionnaire covered the study research topic. The feedback given informed revision of the draft research questionnaire as outlined below:

i. To ensure that the main terms used in the study were interpreted as intended in the study, a section with definitions of the key terms used was deemed necessary. This was to ensure that all the respondents interpreted the questions with a basic common understanding;
ii. As part of profiling the respondents, it was deemed important to have a question as to the number of interior design projects they were handling as of the time they filled in the questionnaire. This was with the aim of assessing the extent of opportunities they had of ensuring sustainable construction compliance; and
iii. For question 10 in the questionnaire, given the nature of the question, it was deemed necessary to change the wording in the applicable Likert scale. This was from 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good to 1 = strongly disagree, 2 = disagree, 3 = indifferent, 4 = agree and 5 = strongly agree.

With the above revisions, the involved professionals confirmed the research instrument to adequately cover sustainability compliance as explored in this study.

The second category of validity evaluated in this study was external validity. According to Campbell and Stanley (1963), external validity is the definition of the population, to which settings, independent variables and dependent variables the research findings can be generalized. The findings of this study can be generalized to the following outlined extent

specifically for general architectural and interior design market segments of the construction industry:

i. Population – Key project professionals' - Interior designers, architects, electrical engineers, mechanical engineers, quantity surveyors and contractors;
ii. Settings – Kenyan construction industry;
iii. Independent variables – Sustainable construction literacy, uptake/transition and assessment/evaluation; and
iv. Dependent variable – Sustainable construction compliance.

3.6.2 Research Instruments Reliability

According to Kothari (2004), reliability of a research instrument is the extent to which it yields results that are consistent in nature. There are two aspects in regards to reliability, these are:

i. Stability of the research instrument - This is the extent to which the research instrument yields the same results for one person using the same instrument on numerous occasions; and
ii. Equivalence of the research instrument - This measures the amount of error that results due to a change in the person using the research instrument and/or different samples of the subject of interest of the research in context.

As recommended by Kothari (2004), the researcher enhanced stability and equivalence of the proposed research instruments through the following approaches:

i. To enhance the stability aspect, data was collected before noon to ensure that the sampling units were engaged in a standard span of time. This was aimed at minimizing external sources of variation specifically boredom and fatigue; and
ii. To enhance equivalence, the following were the measures employed:
    a) The 5 research assistants used for this study were trained by the researcher on how to explain the purpose, intended benefits and beneficiaries of the study including assuring the respondents of anonymity and confidentiality to enhance clarity as to the nature of the study; and
    b) Standard directions of administering the questionnaires were devised to ensure there was no variation as to how the questionnaires were administered from one person to another. This was by ensuring that the nature of study as described above was

made clear to all respondents and that no questionnaire was administered after mid-day in line with (i) above.

3.7 Data Analysis and Presentation

3.7.1 Unit of Analysis and Unit of Observation

Trochim (2000) defines the unit of analysis as the major unit being analysed in a given research study and it is determined by the level at which data is analysed. For this study, the data that goes into analysis is the perspective of key interior design project professionals in terms of frequencies. Frequencies were obtained from key professionals' responses to the questions as outlined in the questionnaire in appendix 4. It can therefore be deduced that the individual, key professional (interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and contractors) was the unit of analysis for this study. Babbie (2013) postulates that further to unit of analysis in a given study, there are the specific study elements from which data used for analysis is collected and these are called the units of observation. Additionally, the unit of analysis in a given study is usually the unit of observation. For this specific study, data was collected from key interior design project professionals as outlined above. As such the unit of observation for the study was still the individual professional. The unit of analysis and unit of observation for this study was one and the same item, that is, individual key interior design project professional.

3.7.2 Likert Data Analysis – An Overview

Likert data can be of Likert-type or Likert scale nature. These categories of Likert data have been identified to call for different descriptive and inferential statistical approaches to data analysis. This highlights the implied importance of identifying the nature of Likert data one is analysing prior to determination of appropriate data analysis approaches. Likert-type data is as a result of single questions on a Likert scale or a collection of such questions where there is no attempt to sum up the responses into a composite score. For this category, descriptive statistics are carried out through median or mode (central tendency) and frequencies (variability). For inferential statistics, this is through Kendall tau B or C and/or chi-square. On the other hand, Likert scale data results from a series of questions on Likert scale with attempts to combine the results into a composite score. This category of Likert data, for descriptive statistics, calls for mean (central tendency) and standard deviation (variability). On inferential statistics, this is

done through Pearson's *r*, analysis of variance, *t*-test and/or regression (Boone and Boone, 2012).

For this study, the main questions were on a 5-point Likert scale and were grouped for the different research variables and elements of the variables. Further to this, a composite score as to the overall perspective of the professionals on the item being studied for each group of questions was necessary. This was because each group of such questions was related and were on a common research variable. Based on the discussion in the preceding paragraph, the implied nature of the resulting Likert data is that it is of Likert scale nature. Consequently, as postulated by Boone and Boone (2012), the following approaches were available for analysis of the data collected for this study:

i. Descriptive statistics - mean (central tendency) and standard deviation (variability); and
ii. Inferential statistics - Pearson's r, analysis of variance, t-test and/or regression.

3.7.3 Data Analysis (Descriptive and Inferential) and Presentation

For primary data, the analysis took a two-step approach: descriptive statistics for classification, summarizing and explanation of collected data, and inferential statistics for analysing the prepared data in order to test the hypotheses as stated in Section 1.3. Descriptive statistics aspect of the analysis employed measures of distribution (frequencies), proportions (percentages), central tendency (mean) and dispersion (standard deviation). The associated calculations were made on MS Excel 2013 and subsequently presented in form of pie charts, tables and bar graphs. The inferential statistics aspect, for the primary data analysis, was approached through *t*-statistic *p*-value method of hypothesis testing. The actual *t*-statistics were hand computed while the corresponding *p*-values were obtained from an online *p*-value calculator (Social Science Statistics, 2018). The decision rule was based on comparing the computed *t*-statistic *p*-value and the pre-set significance levels for the various variables in this study. Even though *t*-statistic has been extensively recommended for small samples that are less than 30, there are other considerations that make it appropriate for samples greater than 30 as is the case for this study. These are as outlined below:

i. The study assumed that field data was from a normal population. This is simply the assumption that value of interest from the sample taken from random samples will exhibit a bell-shaped distribution when plotted (Rhiel & Wilkie, 1996);

ii. With (i) in place, according to Rhiel & Wilkie (1996), the *t*-distribution is correct regardless of the sample size;
iii. Statistical software's in computing one sample test of the mean where the population standard deviation of the mean is unknown, as is the case for this study, *t*-statistic is used irrespective of the sample size (Rhiel & Wilkie, 1996); and
iv. As postulated by Ozgur & Strasser (2004), the *t*-distribution approaches the *z*-distribution as the sample size increases. This then implies that if the *t*-statistic is typically recommended for a sample size of less than 30, for a sample size of 46, as is the case for this study, it then does not eventually matter whether *t*-statistic or *z*-statistic is used.

The choice of *t*-statistic, as opposed to the other inferential statistics approaches available given the nature of the resulting data (See Section 3.7.2), was informed by the following:

i. Data collected is at interval level of measurement by computation of a composite mean score (From the 5-point Likert scale) thus applicable for parametric inferential statistics (Boone & Boone, 2012);
ii. The hypotheses compare computed sample means to hypothesized population means;
iii. The sample means of sustainability literacy, transition/uptake and assessment/evaluation were known;
iv. The sample standard deviations of sustainability literacy, transition/uptake and assessment/evaluation were known;
v. The population means of sustainability literacy, transition/uptake and assessment/evaluation were unknown. Kingoria (2004) postulates this to be one of the conditions that make *t*-statistic appropriate for data analysis; and
vi. The population standard deviations of sustainability literacy, transition/uptake and assessment/evaluation were unknown. According to Kingoria (2004) and Ozgur & Strasser (2004), this is one of the conditions that necessitate the use of a *t*-statistic for data analysis.

3.8 Ethical Considerations

As postulated by Fouka & Mantzorou (2011), research ethics are rules and guidelines that govern the conduct of researchers [And by extension research assistants as is the case for this

study] aimed at protecting research respondent's dignity including appropriate reporting of realized findings. This section focuses on ethical considerations related to research subjects that were observed as recommended. Firstly, as postulated by Mugenda (2003), this study sought to ensure respondents anonymity by not disclosing sensitive data from the respondents such as ethnic and cultural backgrounds. Moreover, such factors were not relevant to the study anyway. Secondly, the researcher and his research assistants first explained the purpose and intended benefits of the study to the respondents before administering the questionnaires to them as advocated for by Beauchamp & Childress (2001) and Mugenda (2003). Thirdly, as proposed by Blumberg et al. (2005), the researcher, including his research assistants, told the respondents the truth about the study that it was unbiased and had no hidden sponsors. Lastly and in addition to the above considerations, the researcher and research assistants sought voluntary and informed consent by the respondents to participate in the study as postulated by Arminger (1997).

3.9 Conclusion

A quantitative approach was adopted for the study to facilitate understanding of extent of sustainable construction literacy, uptake and assessment as key contributors to sustainable construction in the Kenyan construction industry. Additionally, this approach facilitated deduction of population attributes on the same variables from the sample. The target population was key project professionals in the Kenyan construction industry. The sampling frame was identified as the pool of interior designers/architects, electrical engineers, mechanical engineers, quantity surveyors and contractors in Nairobi City County. They were drawn from completed and ongoing interior design projects within the period 2016-2018 by autonomous interior design firms. From this sampling frame a sample size of 60 respondents, 12 respondents per category, was computed. The study sought their perspectives on aspects of sustainability literacy, uptake and assessment using structured questionnaires. The obtained raw data was entered into MS Excel 2013 program for descriptive statistics analysis. Means, standard deviations, frequencies and percentages were computed for descriptive statistics. For inferential statistics, *t*-statistic values were hand computed while the corresponding *p*-values were obtained using online *p*-value calculators. The resulting *t*-statistic *p*-value scores were used to test the hypotheses as outlined in Section 1.3. The analysis and findings are presented in the next chapter.

CHAPTER 4

DATA ANALYSIS, FINDINGS AND DISCUSSION

4.1 Introduction

This chapter covers the discussion and presentation of the findings from the analyzed data as collected from the study sample as discussed in Chapter 3. Additionally, this chapter helps in interpreting the findings of this study. This is meant to ensure that the resulting findings are communicated as clearly as possible and in a usable format within the confines of the pre-set research hypotheses, questions and objectives as identified in Sections 1.3, 1.4 and 1.5 respectively. Out of 60 questionnaires distributed to the respondents, the 46 returned valid questionnaires were analyzed, using both descriptive and inferential statistics, discussed and presented using tables, charts and graphs, as explained in detail below.

4.2 Response Rate and Distribution

This study targeted 60 respondents in total as the sample size. Their composition was 12 interior designers/architects, 12 electrical engineers, 12 mechanical engineers, 12 quantity surveyors and 12 fit-out contractors. Out of the 60 issued questionnaires 50 were received back and 46 of them found valid for analysis. Their composition was 10 interior designers/architects, 9 electrical engineers, 9 mechanical engineers, 8 quantity surveyors and 10 fit-out contractors. This represents a 77% response rate. This is as shown in table 4.1 below:

Table 4.1: Response Rate

Nature of Responses	**Frequency**	**Percentage**
Valid Responses	46	77%
Invalid Responses (Incompletely Filled)	4	6%
Did Not Respond	10	17%
Total No. of Respondents	**60**	**100%**

Source: Field Survey, 2019

Mugenda and Mugenda (2008) postulate that a response rate of 50% is adequate for analysis, 60% good and 70% very good. The above illustrated response rate of 46 (77%) represents well

filled questionnaires. 10 (17%) of the respondents did not return the questionnaires for reasons unknown to the researcher.

4.3 Profile of Respondents

The study sought to profile the respondents. This was specifically on elements that in one way or the other have a bearing on sustainable construction practice in interior design market segment of the construction industry as discussed below in detail:

4.3.1 Respondents Typical Role in Interior Design Projects

The study deemed it fit to establish the typical role of respondents in interior design projects. This was geared at ensuring that only respondents falling within the pre-defined sample categories filled the questionnaires. Out of the 46 respondents, 10 (22%) were interior designers/architects, 9 (19.5%) electrical engineers, 9 (19.5%) mechanical engineers, 8 (17%) quantity surveyors and 10 (22%) fit-out contractors. This is as shown in Table 4.2 below:

Table 4.2: Respondents Typical Role in Interior Design Projects

Categories of Respondents	**Frequency**	**Percentage**
Interior designers/Architects	10	22%
Electrical engineers	9	19.5%
Mechanical engineers	9	19.5%
Quantity surveyors	8	17%
Fit-out contractors	10	22%
Total No. of Respondents	**46**	**100%**

Source: Field Survey, 2019

These findings reveal that all the respondent's categories were well represented and that only the pre-set categories of key interior design professionals in the Kenyan construction industry, specifically in Nairobi City County, participated in the study. This is as illustrated in Figure 4.1 next page:

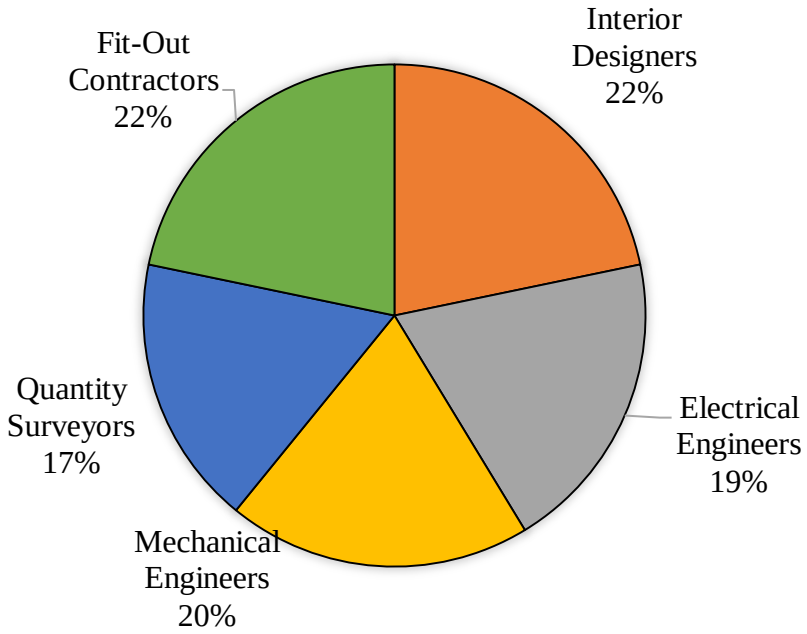


Figure 4.1: Respondents Typical Role in Interior Design Projects

Source: Field Survey, 2019

4.3.2 Respondents Experience in Interior Design Projects

Secondly, the respondents were asked to tick as appropriate their respective work experience in interior design projects. This was important in ascertaining the implied levels of understanding on matters interior design projects. Of the 46 valid study respondents, 1 (2%) had less than 1-year experience in interior design projects, 3 (7%) had 1-2 years' experience, 5 (11%) had 3-4 years' experience and 37 (80%) had over 5 years' experience. This is as shown in Table 4.3 and Figure 4.2 below:

Table 4.3: Respondents Experience in Interior Design Projects

Categories of Experience	**Frequency**	**Percentage**
< 1 Year	1	2%
1-2 Years	3	7%
3-4 Years	5	11%
> Over 5 Years	37	80%
Total No. of Respondents	**46**	**100%**

Source: Field Survey, 2019

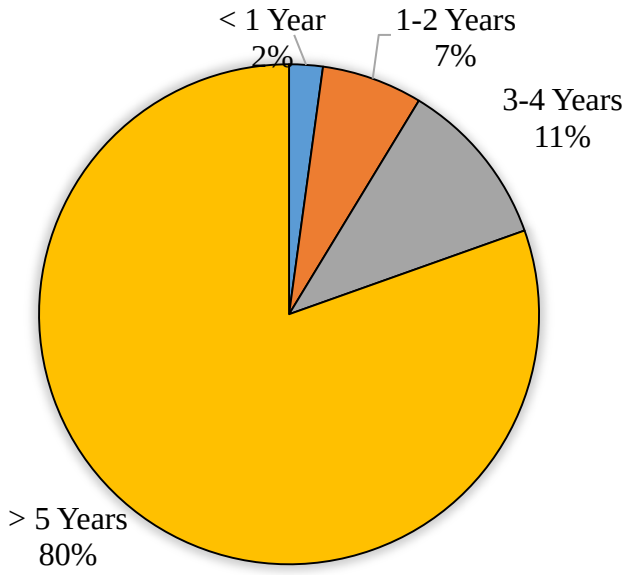


Figure 4.2: Respondents Experience in Interior Design Projects

Source: Field Survey, 2019

As illustrated above, 80% (37) of the study respondents had working experience in interior design projects for over 5 years. This indicates that majority of the respondents were conversant with the peculiarities of interior design projects. This implies that most of the respondents were in a position to adequately ensure sustainable construction practices are structured to the context of the interior design market segment of the Kenyan construction industry.

4.3.3 Number of Interior Design Projects Handled by the Respondents

Thirdly, the study sought to establish the number of interior design projects that were being handled by the respondents at the time of data collection. This was aimed at ensuring that the respondents are actively practicing in the interior design market segment of the construction industry.1 (2%) had less than 2 interior design projects, 13 (28%) had 2-3 projects, 3 (7%) had 4-5 projects and 29 (63%) had over 5 projects. This is as shown in Table 4.4 and Figure 4.3 below:

Table 4.4: Number of Interior Design Projects Handled by the Respondents

Categories of Project Numbers	**Frequency**	**Percentage**
< 2 Projects	1	2%

2-3 Projects	13	28%
4-5 Projects	3	7%
> Over 5 Projects	29	63%
Total No. of Respondents	**46**	**100%**

Source: Field Survey, 2019

The above data is illustrated below:

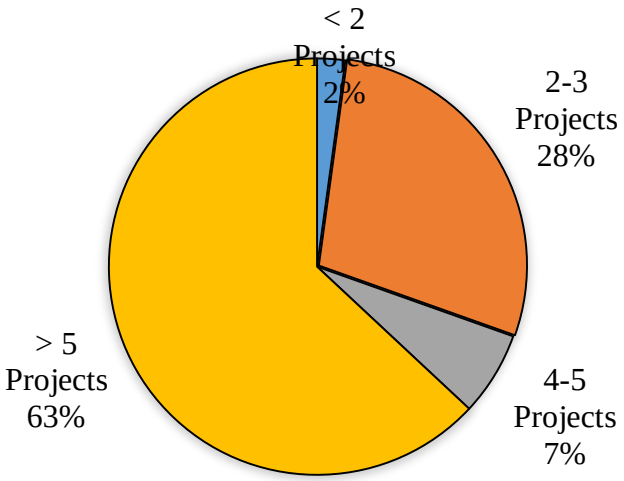


Figure 4.3: Number of Interior Design Projects Handled by the Respondents

Source: Field Survey, 2019

As illustrated above, all the respondents were actively practising in the interior design market segment of the construction industry by the time of data collection for this study. 98% of the respondents had 2 or more active interior design projects. The consequent implication of this is that most of the respondents had sufficient opportunity to practice and promote sustainable construction practices.

4.3.4 Respondents Highest Level of Education

Lastly, the respondents were asked to tick as appropriate their highest level of education. With the three independent variables, sustainability literacy, uptake/transition and assessment/evaluation having links with learning at a tertiary level, the study found it appropriate to profile the highest academic levels of the respondents. 0 (0%) of the respondents had attained a maximum of primary level of education and below, 0 (0%) had a maximum of secondary level of education, 2 (4%) had a maximum of college level of education and 44

(96%) had a maximum of university level of education. This is as shown in Table 4.5 and Figure 4.4 below:

Table 4.5: Respondents Highest Level of Education

Highest Education Level	**Frequency**	**Percentage**
Primary Level and Below	0	0%
Secondary Level	0	0%
College Level	2	4%
University Level	44	96%
Total No. of Respondents	**46**	**100%**

Source: Field Survey, 2019

The above data is illustrated below:

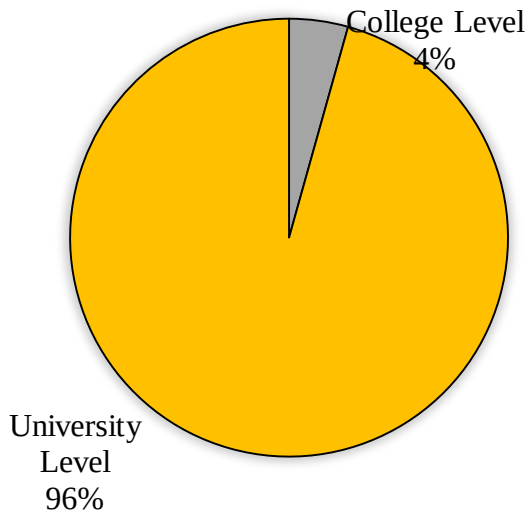


Figure 4.4: Respondents Highest Level of Education

Source: Field Survey, 2019

The findings illustrated above depict a well-educated group of respondents with an overwhelming majority having university as their highest level of education. The implication is that a majority of the key professionals in the interior design market segment are better placed to adequately comprehend and articulate issues on sustainable construction given their academic credentials.

4.4 Extent of Construction Sustainability Literacy as a Key Contributor to Sustainable Construction Compliance

4.4.1 Sustainability Literacy Levels

On this specific variable, the study sought respondent's perspectives on their understanding/literacy levels of sustainable construction practices. This was by requesting them to rank their understanding/literacy levels of the three dimensions of sustainability in construction individually on a 5-point Likert scale. This was with an ultimate intention of computing a composite score for overall respondents understanding levels of the three dimensions of sustainability. Mean item scores and standard deviations were computed to facilitate ranking of the findings. The findings were meant to offer an understanding of sustainable construction literacy levels amongst key interior design project professionals in Nairobi City County. The results obtained are as shown in Table 4.6 below:

Table 4.6: Respondents Sustainable Construction Practices Understanding Levels

Sustainable Construction Practices	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Economic related practices such as ensuring lifecycle cost efficiency	0	2	16	19	9	3.7609	**0.8215**
Environmental related practices such as ensuring reduction of project related emissions and minimizing waste	2	3	14	16	11	3.6739	**1.0552**
Social related practices such as ensuring fair labor practices and access by the physically challenged	1	2	15	20	8	3.6957	**0.8912**
Grand Mean (Composite Score)						**3.7102**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

In reference to Table 4.6 in the previous page, the respondents had an average (Mean=3.7102) understanding of sustainable construction practices: economic, environmental and social. Specifically, economic related construction practices scored the highest level of understanding with a mean of 3.7609 (Standard deviation=0.8215). Socially related construction practices ranked second on understanding levels among the respondents with a mean of 3.6957 (Standard deviation=0.8912). Environmental related construction practices ranked third with a mean score of 3.6739 (Standard deviation=1.0552). These findings are partly consistent with Njoroge (2013), Zuo et. al. (2014) and Boyer et al. (2016). The cited studies highlight that much scholarly attention has been given to the economic and environmental dimensions compared to the social dimension. This would imply that key construction professionals understanding levels of sustainable construction would rank economic and environmental dimensions higher than the social dimension. The findings however rank the understanding/literacy levels as economic, social and environmental in decreasing order of understanding/literacy. However, the findings are consistent with the said postulations on the fact that the economic dimension of sustainability has received much attention both scholarly and in terms of understanding levels amongst key practitioners in the Kenyan interior design market segment of the construction industry. The above data is illustrated in Figure 4.5 below:

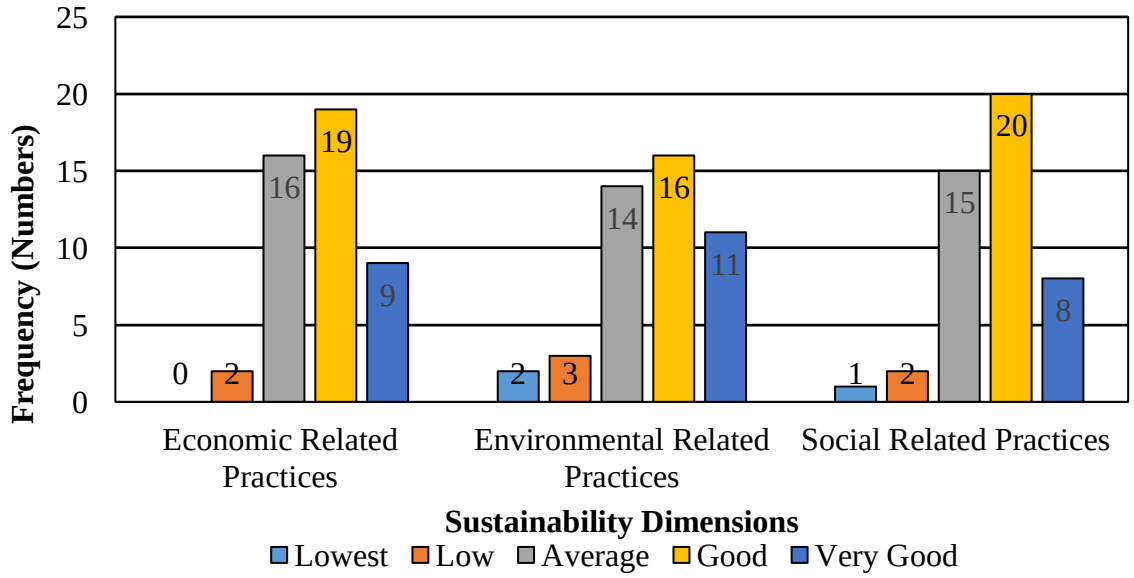


Figure 4.5: Respondents Sustainable Construction Practices Understanding Levels

Source: Field Survey, 2019

4.4.2 Key Sustainability Considerations in Interior Design Projects

The researcher sought to establish the key sustainability considerations by key interior design project professionals in a typical interior design project. This was by requesting them to rank their key project sustainability considerations for the three dimensions of sustainability in construction individually on a 5-point Likert scale. This was with an ultimate intention of computing a composite score for overall respondents' consideration levels of sustainable construction benefits in interior design projects. To facilitate ranking of the findings, mean item scores and standard deviations were computed. This was aimed at providing insights on the extent sustainability literacy was informing sustainable construction practice amongst key interior design project professionals in Nairobi City County. The results are as shown in Table 4.7 below:

Table 4.7: Respondents Key Sustainability Concerns in Interior Design Projects

Sustainable Construction Benefits	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Economic Benefits such as avoiding increased exposure to green taxes, safeguarding reputation, avoiding resistance for pressure groups, rationalized operating and maintenance costs and increased revenue which can be realized through sale or rent of constructed facilities	4	7	12	20	3	3.2391	**1.0788**
Environmental Benefits such as improved quality of the surroundings and rationalized use of	2	4	6	26	8	3.7391	**0.9985**

natural resources and energy							
Social Benefits such as health and safety, enhanced wellbeing, reducing abseentism, reduced rate of employee turnover and reduced liabilities	1	4	8	23	10	3.8043	**0.9573**
Grand Mean (Composite Score)						**3.5942**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

As outlined in Table 4.7 above, the respondents registered an average score (Mean=3.5942) as overall consideration levels of the sustainable construction benefits in interior design projects. Specifically, the respondent's responses indicated that they consider social benefits to rank higher (Mean=3.8043, Standard deviation=0.9573) than environmental and economic benefits. Environmental benefits as a key consideration ranked second (Mean=3.7391, Standard deviation=0.9985) with economic benefits ranking third (Mean=3.2391, Standard deviation=1.0788). These findings are contrary to sustainable construction understanding levels which ranked the three dimensions of sustainability as economic, social and environment in decreasing order of understanding levels. These findings are partly inconsistent with Njoroge (2013), Zuo et al. (2014) and Boyer et al. (2016). The cited studies highlight that much scholarly attention has been given to the economic and environmental sustainability dimensions compared to the social dimension. This implies that in practice, economic and environmental sustainability dimensions would be key considerations in construction projects compared to the social dimension. This study ranks the social and environmental sustainability dimensions as key considerations in interior design projects compared to economic dimension. However, the findings are consistent with the said postulations on the fact that the environmental dimension of sustainability has received much attention both scholarly and as a key consideration in Kenyan interior design market segment of the construction industry. The above data is illustrated in Figure 4.6 next page:

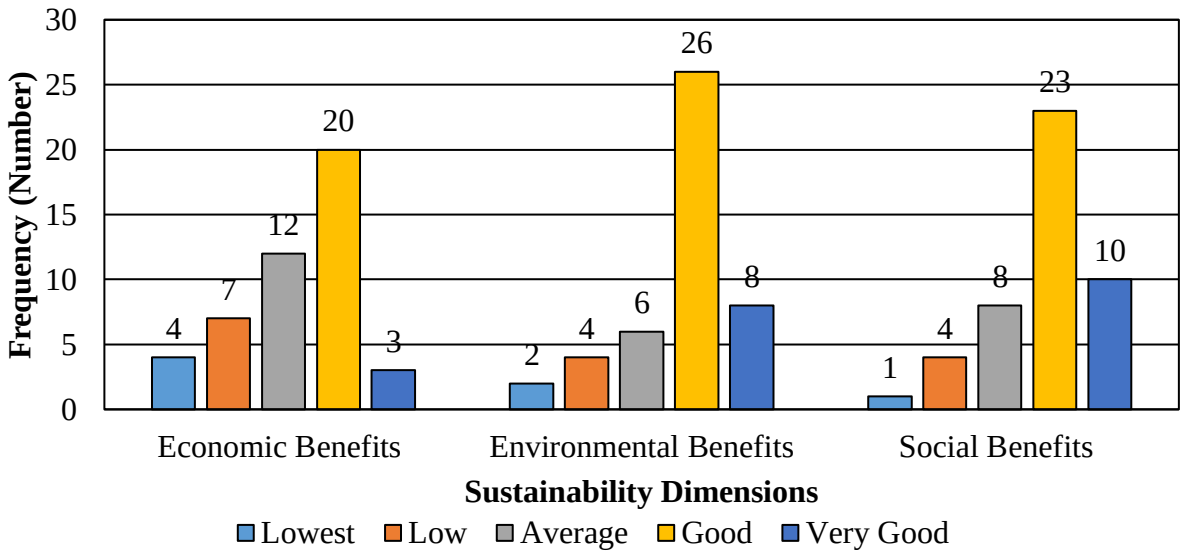


Figure 4.6: Respondents Key Sustainability Concerns in Interior Design Projects

Source: Field Survey, 2019

4.4.3 Sources of Sustainable Construction Information

Whilst on sustainability literacy as one of the independent variables, the researcher sought to establish how the respondents rank the various sustainable construction learning channels. This was by requesting them to rank the contribution of the various learning avenues to their current sustainable construction literacy levels on a 5-point Likert scale. This was with an ultimate intention of computing a composite score for overall respondents' rating of the contribution of identified sustainable construction learning avenues to their current sustainability literacy levels. The findings were ranked by using computed item means and standard deviations. This was aimed at providing an understanding on the effectiveness of the various sustainable construction learning avenues amongst key interior design project professionals in Nairobi City County. The results are as shown in Table 4.8 below:

Table 4.8: Sources of Sustainable Construction Information

Sustainable Construction Learning Avenues	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Construction professionals'	4	4	11	20	7	3.4783	**1.1302**

associations influence through CPDs and degree courses							
Construction trade associations influence such as KABCEC stakeholder engagement forums	12	15	7	11	1	2.4348	**1.1861**
Standard sustainability approaches such as BREEAM and LEED	9	7	12	12	6	2.9783	**1.3248**
Formal learning (formal curriculum-based education)	4	9	9	19	5	3.2609	**1.1630**
Informal learning as apprenticeship, industrial attachment and online sources	2	4	4	22	14	3.9130	**1.0714**
Sustainability related legislation such as EMCA (1999) for environmental considerations and Employment Act (2007) for social considerations – Laws of Kenya	9	11	12	10	4	2.7609	**1.2505**
Sustainability related policies	10	11	10	10	5	2.7609	**1.3197**
Collaboration amongst firms	5	5	10	15	11	3.4783	**1.2778**
Grand Mean (Composite Score)						**3.1332**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

In reference to Table 4.8, the respondents attributed the joint contribution of the identified sustainable construction learning avenues to their current sustainability literacy levels as average (Mean=3.1332). Informal learning as a sustainable construction learning avenue ranked first with a mean of 3.9130 (Standard deviation=1.0714). Construction professional associations influence and collaboration amongst firms jointly ranked second with mean of 3.4783 (Standard deviation=1.1302) and 3.4783 (Standard deviation=1.2778) respectively. Formal learning ranked third with a mean of 3.2609 (Standard deviation=1.1630) while standard sustainability approaches ranked fourth with a mean of 2.9783 (Standard deviation=1.3248). Sustainability related legislation and policies jointly ranked fourth with means of 2.7609 (Standard deviation=1.2505) and 2.7609 (Standard deviation=1.3197) respectively. Lastly, construction trade associations influence ranked fifth with a mean of 2.4348 (Standard deviation=1.1861). As above outlined, only standard sustainability approaches, sustainability related legislation and policies and influence of construction trade associations had a mean of below 3 (average). It can thus be argued that informal learning, construction professional associations influence, collaboration amongst firms and formal learning are key sustainable construction literacy avenues as postulated by Gleeson & Thomson (2012), Murray & Cotgrave (2007), Sommerville & McCarney (2003) and Higham & Thomson (2015). The above data is illustrated in Figure 4.7 below:

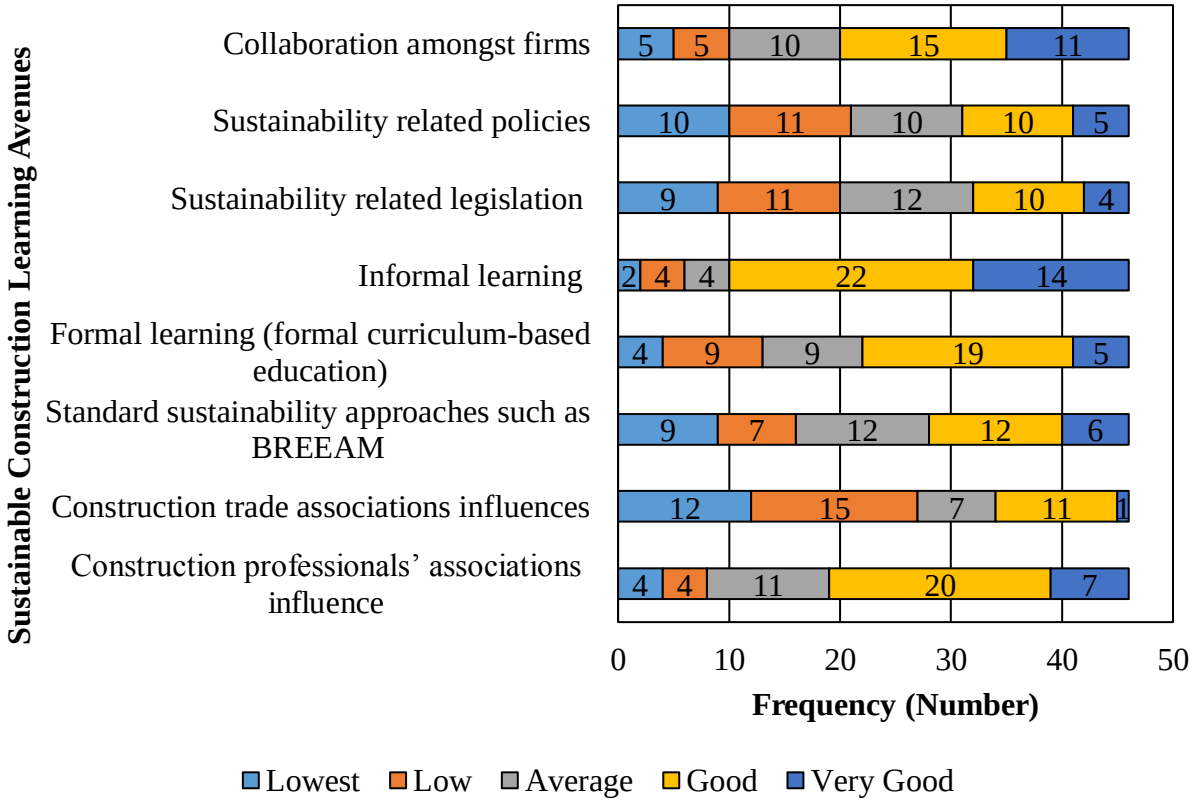


Figure 4.7: Sources of Sustainable Construction Information

Source: Field Survey, 2019

4.5 Extent of Construction Sustainability Transition/Uptake as a Key Contributor to Sustainable Construction Compliance

4.5.1 Sustainability Transition/Uptake Levels

On the second independent variable, the researcher sought the perspectives of amongst key interior design project professionals on sustainable construction uptake levels in Kenyan construction industry. This was by requesting them to rank sustainable construction uptake levels in the Kenyan construction industry for the three sustainability dimensions individually on a 5-point Likert scale. This was with an ultimate intention of computing a composite score for overall respondents' rating of the current sustainable construction practice uptake levels. The uptake levels for the three sustainability dimensions individually was done using the computed means and standard deviations. This was meant to offer understanding on sustainable construction uptake levels in the Kenyan construction industry with specific focus on Nairobi City County. The findings were as shown in Table 4.9 below:

Table 4.9: Sustainability Transition/Uptake Levels

Sustainable Construction Practices	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Economic related practices such as ensuring lifecycle cost efficiency	0	11	18	12	5	3.2391	**0.9472**
Environmental related practices such as ensuring reduction of project related emissions and minimizing waste	1	3	23	18	1	3.3261	**0.7319**
Social related practices such as ensuring fair	0	8	12	21	5	3.5000	**0.9129**

labor practices and access by the physically challenged							
Grand Mean (Composite Score)						**3.3551**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

As illustrated in Table 4.9 above, the respondents rated the overall uptake of sustainable construction practices (Economic, environmental and social) in interior design projects as average (Mean=3.3551). This implies that the three dimensions of sustainability are receiving average uptake levels in the interior design market segment of the Kenyan construction industry. Social related sustainable construction practices ranked first with a mean of 3.5000 (Standard deviation=0.9129). Environmental related sustainable construction practices ranked second with a mean score of 3.3261 (Standard deviation=0.7319). Lastly, economic related sustainable construction practices ranked third with a mean score of 3.2391 (Standard deviation=0.9472). These findings are inconsistent with the sustainability understanding levels of the respondents as discussed in sub-section 4.4.1 where the ranking of understanding/literacy levels was economic related practices, social related practices and environmental related practices in order of decreasing understanding levels. The above data is illustrated in Figure 4.8 below:

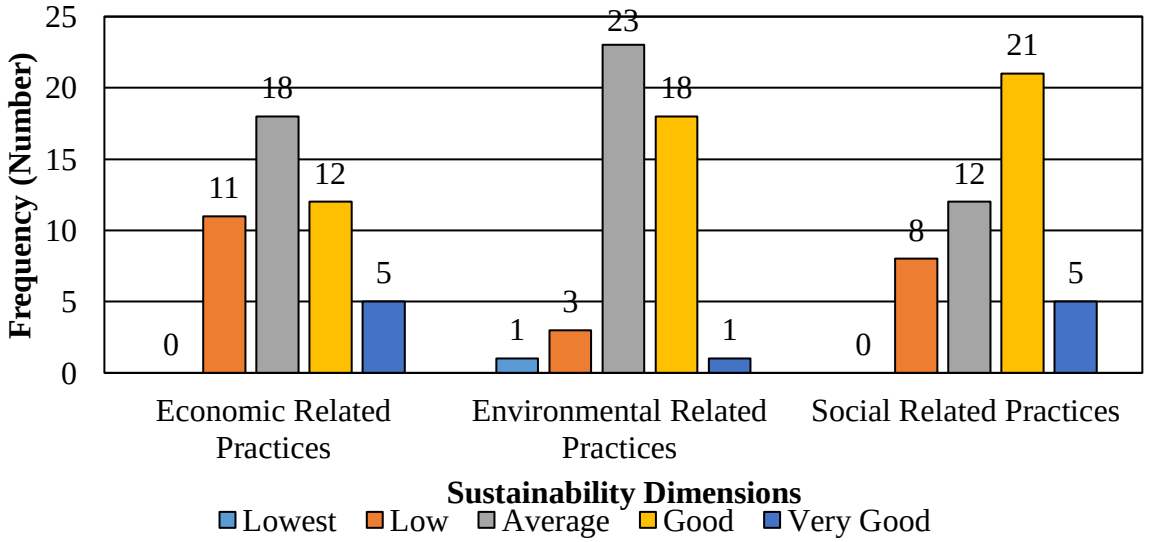


Figure 4.8: Sustainability Transition/Uptake Levels

Source: Field Survey, 2019

4.5.2 Sustainable Construction Drivers

In light of the sustainable construction practice uptake levels as identified in Section 4.5.1, the study had aimed at establishing the key factors that drive the current sustainability levels. The respondents were asked to rank the driver categories as advanced in Section 2.4.3. The responses were on a 5-point Likert scale with the effectiveness of the various driver categories in promoting sustainable construction ranked using computed mean item scores and standard deviations. This was with an ultimate intention of computing a composite score for overall effect of stakeholder related, organizational related, management related and economic related drivers on uptake of sustainable construction practices in the Kenyan construction industry. The results are as shown in Table 4.10 below:

Table 4.10: Sustainable Construction Drivers

Sustainable Construction Drivers	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Stakeholder related drivers such as pressure from clients, pressure from employees, pressure from other stakeholders, legislation and enhanced indoor environment	1	3	7	20	15	3.9783	**0.9773**
Organizational related drivers such as corporate image, organization ethos, alignment of organization (formal and informal) towards sustainability and design process re-engineering	0	0	5	30	11	4.1304	**0.5815**

Management related drivers such as management commitment, training and centralization/integration of efforts towards sustainability	1	7	16	16	6	3.4130	**0.9793**
Economic related drivers such as boosting business performance, lifecycle cost reduction, avoiding sustainability related penalties, enhancing productivity of built assets, innovative products and appropriate incentives	0	5	11	23	7	3.6957	**0.8659**
Grand Mean (Composite Score)						**3.8043**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

From the findings in Table 4.10 above, the overall effect of stakeholder related, organizational related, management related and economic related drivers on uptake of sustainable construction practices in the Kenyan construction industry scored average (Mean=3.8043). Organization related drivers ranked first as having the highest influence on uptake of sustainable construction practices with a mean of 4.1304 (Standard deviation=0.5815). Stakeholder related drivers ranked second with a mean of 3.9783 (Standard deviation=0.9773) followed by economic related drivers which ranked third with a mean of 3.6957 (Standard deviation=0.8659). Lastly, management related drivers ranked fourth with a mean of 3.4130 (Standard deviation=0.9793). With all scores above average, the findings imply that the four categories of drivers are key influencers of uptake of sustainable construction practices. As such, this validates the sustainable construction driver's, within the sample geographical confines, postulated by Basu

& Palazzo (2008), Fairfield et al. (2011), Elmualim, et al. (2012), Manoliadis & Tsolas (2006) and Wirtenberg et al. (2007). The above data is illustrated in Figure 4.9 below:

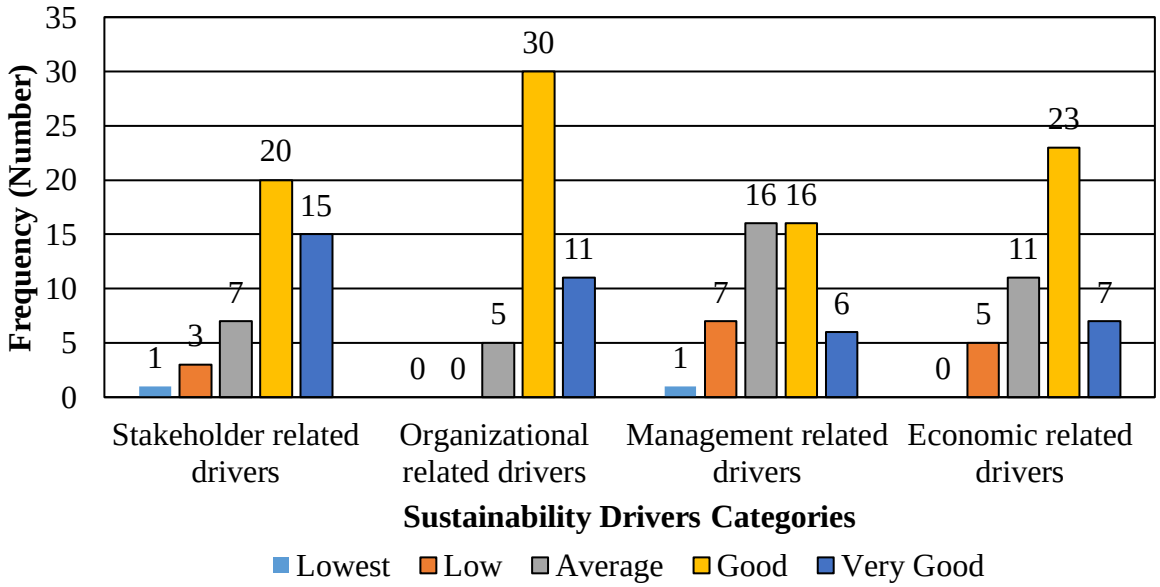


Figure 4.9: Sustainable Construction Drivers

Source: Field Survey, 2019

4.5.3 Sustainable Construction Barriers

In addition to identifying key sustainability driver categories as in sub-section 4.5.2, this study aimed at identifying the key factor categories impeding sustainable construction uptake in Kenya. Similar to the driver categories in Section 4.5.2, the barrier categories were ranked using the computed means and standard deviations. Additionally, the study ultimately aimed at computing a composite score for overall effect of economic related, professional/capacity related, society/cultural related and technology related barriers on uptake of sustainable construction practices in the Kenyan construction industry. The findings are shown in Table 4.11 below:

Table 4.11: Sustainable Construction Barriers

Sustainable Construction Barriers	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Economic related barriers such as							

increased project cost, increased project duration, uncertain economic environment, poverty, low urban development and lack of government support	0	2	0	19	25	4.4565	**0.7213**
Professional/capacity related barriers such as lack of appropriate knowledge/information, lack of sustainable construction materials, lack of appropriate sustainability evaluation tools, lack of appropriate building codes and regulations, lack of appropriate professional expertise and inefficient coordination between design and construction teams	1	8	8	19	10	3.6304	**1.0824**
Societal/cultural related barriers such as lack of interest, lack of incentives, resistance to change, limited awareness and lack of demand	0	9	12	15	10	3.5652	**1.0467**
Technology related barriers such as uncertainty of							

sustainability technology performance, failure to understand sustainable technology work, inadequate technology specifications on sustainable approaches and unavailability of appropriate sustainability technologies	1	5	15	16	9	3.5870	**1.0017**
Grand Mean (Composite Score)						**3.8098**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

With reference to Table 4.11 above, the overall joint effect of economic related, professional/capacity related, society/cultural related and technology related barriers on uptake of sustainable construction practices in the Kenyan construction industry had an average score (Mean=3.8098). Economic related barriers ranked first, as the key barrier to sustainable construction practices, with a mean score of 4.4565 (Standard deviation=0.7213). Professional/capacity related barriers ranked second with a mean score of 3.6304 (Standard deviation=1.0824) while technology related barriers ranked third with a mean score of 3.5870 (Standard deviation=1.0017). Lastly, societal/cultural related barriers ranked fourth with a mean score of 3.5652 (Standard deviation=1.0467). With all scores above average, the findings imply that the four categories of barriers are key influencers of uptake of sustainable construction practices. As such, this validates the sustainable construction barriers, within the sample geographical confines, postulated by Du Plessis (2002), Zhou & Lowe (2003), Williams & Dair (2007), Powmya & Abidin (2014) and Djokoto et al., (2014). The above data is illustrated in Figure 4.10 next page:

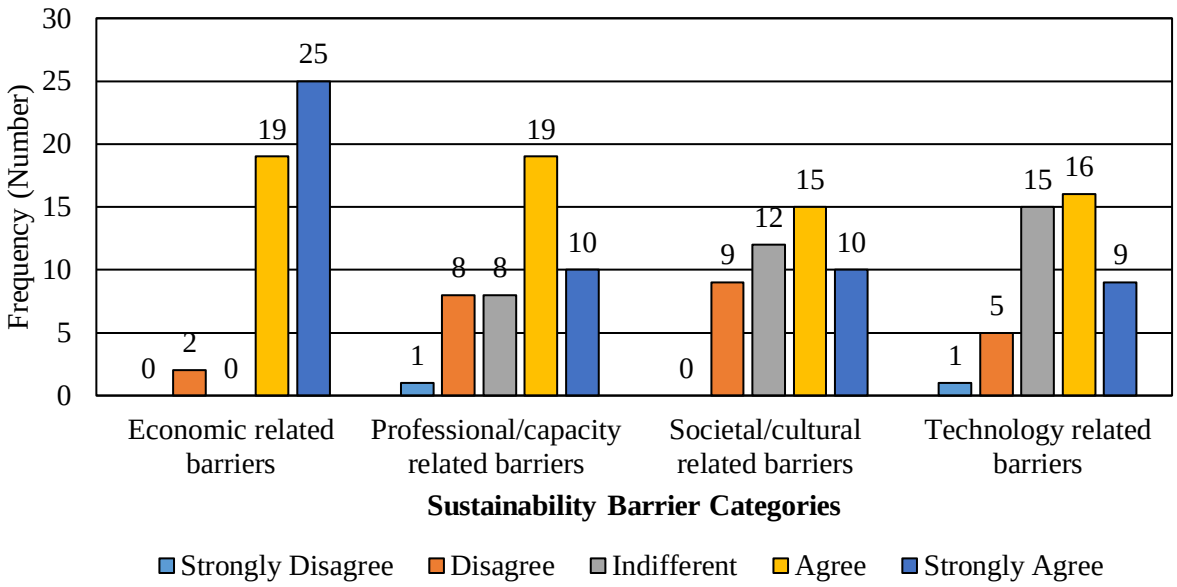


Figure 4.10: Sustainable Construction Barriers

Source: Field Survey, 2019

4.6 Extent of Construction Sustainability Assessment/Evaluation as a Key Contributor to Sustainable Construction Compliance

4.6.1 Sustainable Construction Assessment

On this third and last independent variable, sustainable construction assessment, this study sought to establish whether key interior design project professionals were assessing sustainable construction or not. Additionally, in cases where the respondents did not assess sustainability in interior design projects, the researcher sought to establish reasons why. The findings were as shown in Table 4.12 below:

Table 4.12: Sustainable Construction Assessment in Interior Design Projects

Question: Do you typically assess/evaluate sustainability (Economic, environmental and social) performance over the lifecycle of a typical interior design project?		
Answer Categories	**Frequency**	**Percentage**
Yes	10	22%
No	36	78%
Totals	**46**	**100%**

Source: Field Survey, 2019

From Table 4.12, majority 36(78%) of the respondents reported not typically assessing sustainable construction performance in interior design projects. This can be partly attributed to the fact that in Kenya no BSAM (Incorporating the three sustainability dimensions) has been developed or suitably adapted nor has there been an International Standard on sustainability adapted for local application. A minority of 10(22%) reported to typically assessing sustainable construction performance in interior design projects. The above tabulated data is illustrated in Figure 4.11 below:

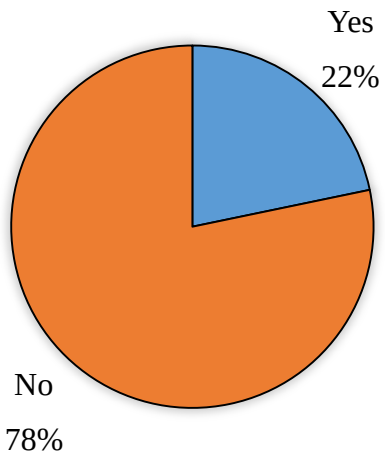


Figure 4.11: Sustainable Construction Assessment in Interior Design Projects
Source: Field Survey, 2019

For the respondents whose response was NO to the above question, they attributed their non-assessment to the following:

i. Sustainability assessment not being a project requirement;
ii. Lack of appropriate assessment tools;
iii. Sustainability being rarely an interior design project objective;
iv. There existing no lifecycle sustainability assessments frameworks for interior design projects;
v. Not being aware of any sustainability assessment standard and/or guide;
vi. Clients perception of sustainable construction practices as costly hence not pursued;
vii. There existing no opportunity to assess sustainability in interior design projects;
viii. Perception that sustainability can and should only be assessed by the project design team;
ix. There being barely the time and need for such an exercise;

x. Not being a typical quantity surveying scope of works; and

xi. Lack of appropriate incentives.

4.6.2 Sustainable Construction Assessment Standards and Tools

This study further sought to establish respondent's familiarity with sustainable construction assessment standards and/or tools for the three dimensions of sustainability. The respondents were requested to rate their familiarity with sustainable construction assessment standards and/or tools for the three dimensions of sustainability individually. The responses were on a 5-point Likert scale with the results ranked using computed means and standard deviations. Lastly, composite score for overall respondent's familiarity levels for the assessment standards/tools for the three dimensions of sustainability jointly was computed. Table 4.13 below presents the resulting findings:

Table 4.13: Sustainable Construction Assessment Standards and Tools

Sustainable Construction Assessment Standards and Tools	**Response Frequencies**					**Mean & Standard Deviation**	
	1	**2**	**3**	**4**	**5**	**Mean**	**Standard Deviation**
Economic aspects assessment standards and/or tools such as Cost Reference Model (Netherlands), Lifecycle (UK), GaBi3 (Germany) and BLCC, QuickBLCC & LCCID (USA)	23	13	8	2	0	1.7609	**0.8990**
Environmental aspects assessment standards and/or tools such as GBTool (International), LEED & SpiRiT (USA), Equer (France),							

BREEAM (UK), OGIP (Switzerland) and H-K Beam (Hong Kong)	16	14	9	7	0	2.1522	**1.0743**
Social aspects assessment standards and/or tools such as social surveys, questionnaires, interviews and statistics such as census data, social-cost benefit analysis, marketing information and field research	14	9	10	10	3	2.5435	**1.3116**
Grand Mean (Composite Score)						**2.1522**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

As highlighted in Table 4.13 above, respondent's overall familiarity levels for the assessment standards/tools for the three dimensions of sustainability jointly scored a low – below average – (Mean=2.1522). The respondents ranked their familiarity with social aspects assessment standards/tools as the highest, ranking first, with a mean of 2.5435 (Standard deviation=1.3116), environmental aspects assessment standards/tools second with a mean of 2.1522 (Standard deviation=1.0743) and economic aspects assessment standards/tools third with a mean of 1.7609 (Standard deviation=0.8990). These findings are consistent with the sustainable construction uptake levels of the respondents as discussed in Section 4.5.1 where the ranking of uptake levels was social related practices, environment related practices and economic related practices in order of decreasing uptake levels. This is illustrated in Figure 4.12 next page:

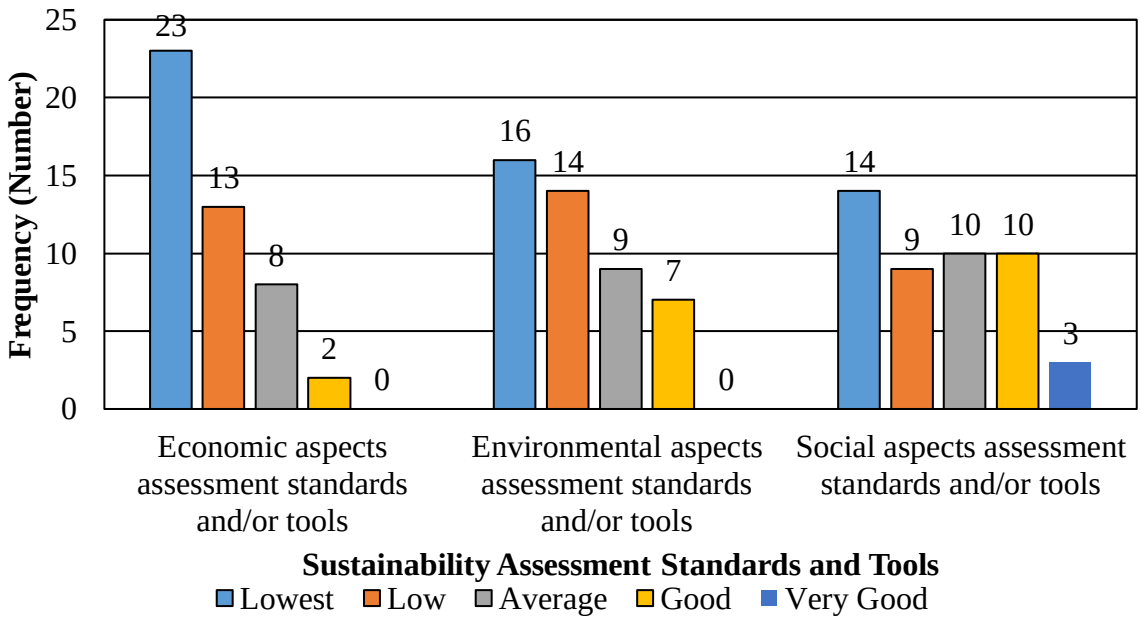


Figure 4.12: Sustainable Construction Assessment Standards and Tools

Source: Field Survey, 2019

4.6.3 Sustainable Construction Indicator Purposes

The researcher also aimed at establishing if the respondents were aware of operational measures of value for sustainability attributes (SI's) functionally. This was meant to offer an understanding as to the extent the respondents were conversant with practical approaches for incorporating sustainable construction practices in construction projects. It additionally included providing insights on extent of positive shift in attitudes, views and knowledge towards sustainability construction practices. The findings are as summarized in Table 4.14 below:

Table 4.14: Sustainable Construction Indicator Purposes

Sustainability Indicator Purposes	Responses	
	Yes	No
I have information well-structured for sustainability decision making	21	25
I am aware of how to practically apply sustainability in interior design projects	29	17
There is substantial (positive) shift in attitudes, views and knowledge towards sustainability in interior design projects	24	22

I am aware of how to measure the performance of the various sustainability aspects in construction projects	10	36
I am aware of the various information needs regarding sustainability in interior design projects and how to fill them	20	26
Totals (Frequencies)	**104**	**126**
Totals (Percentages)	**45%**	**55%**

Source: Field Survey, 2019

As outlined in Table 4.14 above, on adding the frequencies of responses to the various questions, a minority of the respondents, 104 (45%), responded as being familiar with operational measures of value for sustainability. This was implied from their responses in affirmative to the purposes of sustainable construction indicators. On the other hand, a majority of the respondents, 126 (55%) responded as not being familiar with operational measures of value for sustainability. This was implied from their non-supportive responses to the purposes of sustainable construction indicators. This implies an almost average level of familiarity with measurable operational expressions of value for sustainability attributes (Economic, environmental and social) in the Kenyan construction industry. This is as illustrated in Figure 4.13 below:

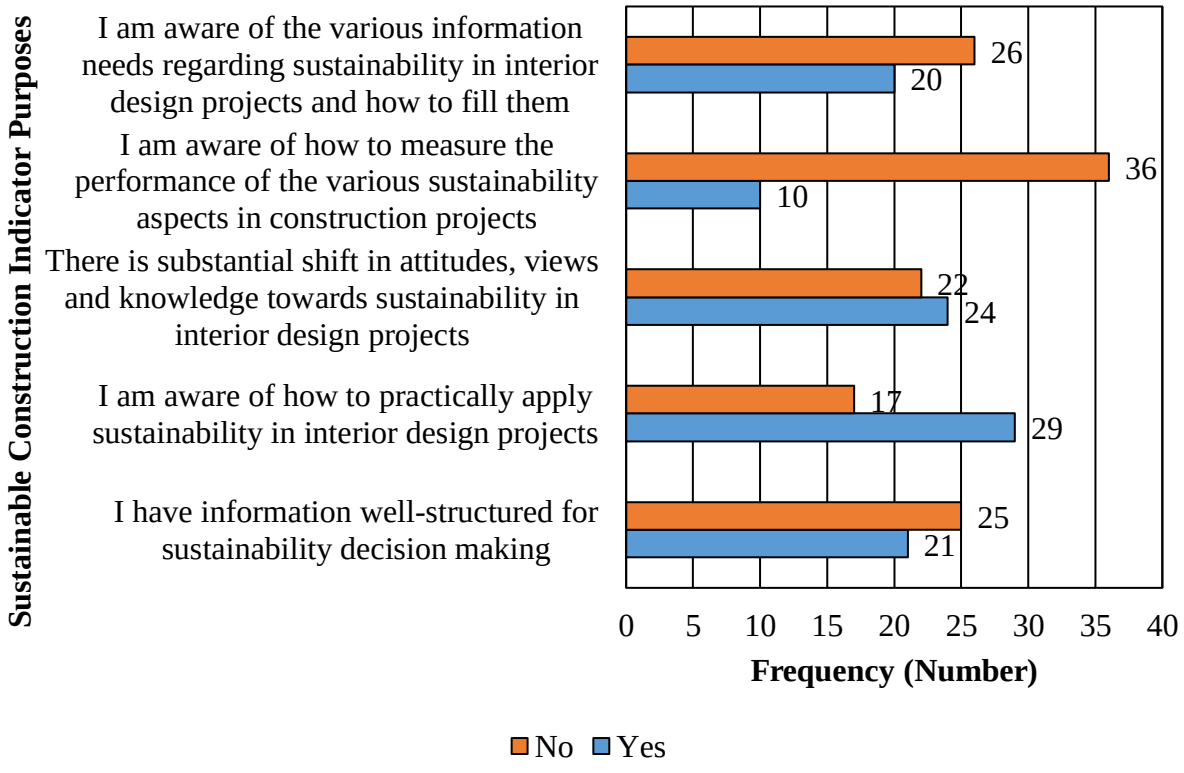


Figure 4.13: Sustainable Construction Indicator Purposes

Source: Field Survey, 2019

4.6.4 Sustainable Construction Assessment Frameworks

Lastly on this independent variable, the researcher sought to establish respondent's familiarity with sustainability assessment frameworks covering the three-dimensions of sustainability jointly. This was aimed at finding out the extent to which the respondents were conversant with an approach to assess the three dimensions of sustainability in construction projects. The findings were as shown in Table 4.15 below:

Table 4.15: Familiarity with Sustainable Construction Assessment Frameworks

Question: Are you familiar with any framework that guides sustainability assessment of the three dimensions of sustainability (Economic, environmental and social aspects) jointly in interior design projects?		
Answer	**Frequency**	**Percentage**
Yes	5	11%
No	41	89%
Totals	**46**	**100%**

Source: Field Survey, 2019

As highlighted in Table 4.15 above, 41 (89%) of the respondents were not familiar with sustainability assessment frameworks covering the three-dimensions of sustainability jointly. On the other hand, 5 (11%) of the respondents were familiar with such an assessment framework. This implies the need for development and/or awareness campaigns for such an assessment framework cognisant of the peculiarities of the Kenyan construction industry. This is as illustrated in Figure 4.14 next page:

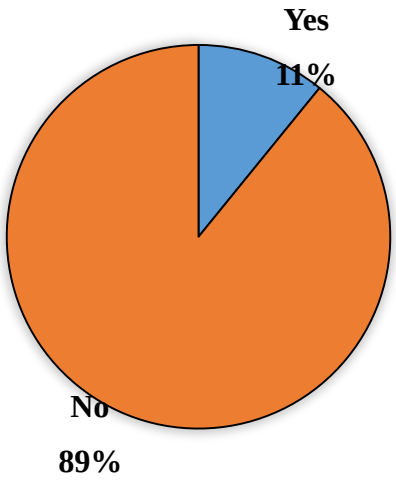


Figure 4.14: Familiarity with Sustainable Construction Assessment Frameworks

Source: Field Survey, 2019

4.7 Joint Impact of Construction Sustainability Literacy, Transition and Assessment on Sustainable Construction Compliance

4.7.1 Impacts of Sustainability Literacy, Transition and Assessment on Sustainable Construction Compliance in the Kenyan Construction Industry

The study sought to establish the impact of sustainability literacy, transition and assessment on sustainable construction compliance in the Kenyan construction industry. This was through requesting respondents to rank the impact of sustainability literacy, transition and assessment on sustainable construction compliance on a 5-point Likert scale. The resulting frequencies were analyzed through descriptive statistics of means and standard deviations to facilitate ranking. The study sought to assess individual and joint impact of independent variables on dependent variable in Nairobi City County. The findings were as presented in Table 4.16 below:

Table 4.16: Impacts of Sustainability Literacy, Transition and Assessment on Sustainable Construction Compliance in the Kenyan Construction Industry

Sustainable Construction Practices Aspects	Response Frequencies					Mean & Standard Deviation	
	1	2	3	4	5	Mean	Standard Deviation
Sustainability Literacy	1	8	22	8	7	3.2609	0.9985

Sustainability Transition/Uptake	2	5	23	9	7	3.3043	1.0082
Sustainability Assessment/Evaluation	3	1	22	8	12	3.5435	1.1097
Grand Mean (Composite Score)						**3.3696**	

Key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Source: Field Survey, 2019

With reference to Table 4.16 above, the joint impact of sustainability literacy, transition and assessment on sustainable compliance in the Kenyan construction industry scored an average (Mean=3.3696). Sustainability assessment/evaluation ranked first (Mean= 3.5435, Standard deviation=1.1097) with the highest impact on sustainable construction compliance in the Kenyan construction industry. Sustainability transition/uptake ranked second with a mean of 3.3043 (Standard deviation=1.0082) while sustainability literacy scored third with a mean of 3.2609 (Standard deviation=0.9985). These findings point towards the significant role of sustainable construction literacy, uptake and assessment in promoting sustainable construction compliance in the Kenyan construction industry. This data is as illustrated in Figure 4.15 below:

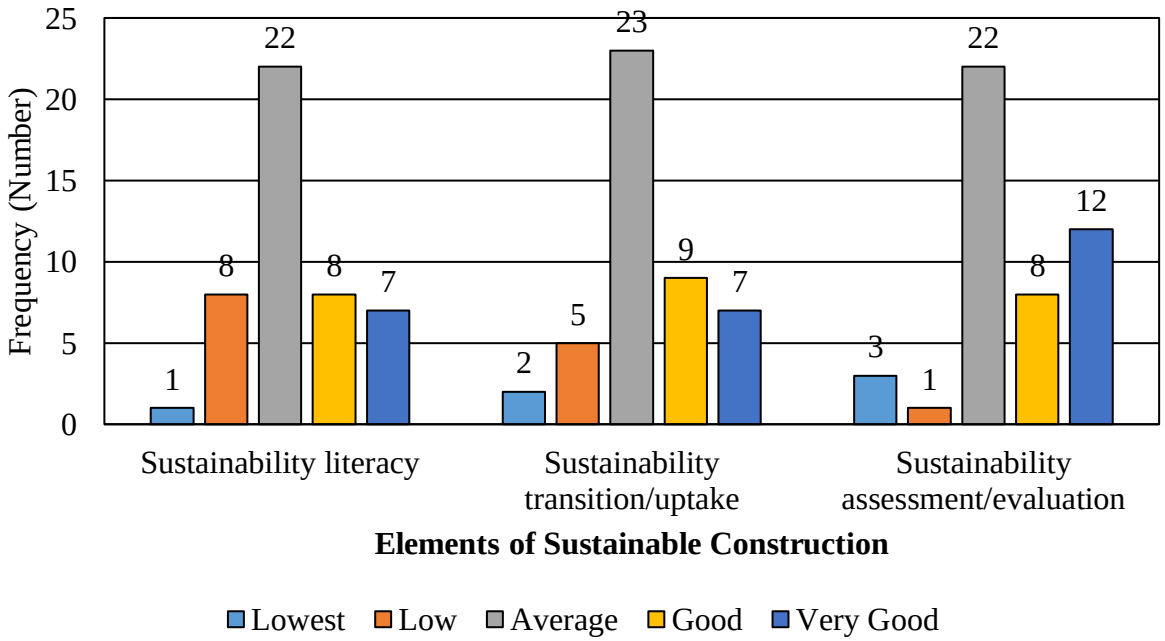


Figure 4.15: Impacts of Sustainability Literacy, Transition and Assessment on Sustainable Construction Compliance in the Kenyan Construction Industry

Source: Field Survey, 2019

4.7.2 Hypothesis Testing on Impact of Sustainability Literacy, Transition and Assessment on Sustainable Construction Compliance in the Kenyan Construction Industry

Hypothesis testing was done to test if the effect of sustainability literacy, transition and assessment on sustainable compliance in the Kenyan construction industry is above or below average. The means and standard deviations were obtained for each variable as computed from the 5-point Likert scale (1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good) frequency scores. From this scale, mean values of above 3 were identified to be of prevalent [Above average] attributes. With this information since the population mean and standard deviations were unknown, the *t*-statistic was found applicable compared to *z*-statistic (Boone & Boone, 2012 and Kingoria, 2004). The study adopted the formula postulated by Rhiel & Wilkie (1996) for the *t*-statistic as illustrated and explained below:

$$t_{(n-1)} = \frac{\bar{X} - \mu}{S / \sqrt{n}}$$

Where:

t = Computed t-statistic

$\bar{X}$ = Sample mean

μ = Hypothesized population mean

S = Sample standard deviation

n = Sample size

n-1 = Applicable degrees of freedom

The resulting *t*-statistic value was entered into an online *p*-value from *t*-score calculator to compute the corresponding *p*-value at the pre-set significance level of 5% (0.05) and as an upper-tail test. The test is taken to be an upper-tail test based on the following narrative:

i. The hypotheses for the study as identified in Section 1.3 are directional. This is implied from the keywords 'above/not above average' in the stated hypotheses; and

ii. Specifically, for the four hypotheses, the hypotheses are of the following nature:

- $H_0 : \mu \leq 3$ (For null hypotheses it was hypothesized to be not above average); and
- $H_A : \mu > 3$ (For alternative hypotheses it was hypothesized to be above average).

With the alternative hypotheses being stated as greater than (>), the tests are consequently upper-tail in nature.

For a *t*-statistic *p*-value of > 0.05 (Significance level) the null hypothesis is upheld and not rejected. On the other hand, for a *t*-statistic *p*-value of < 0.05 (Significance level) the null hypothesis was rejected and the alternative hypothesis accepted. Additionally, a *p*-value of less than 1% (0.01) indicates overwhelming support in favour of alternative hypothesis, between 1% (0.01) and 5% (0.05) indicates strong support in favour of alternative hypothesis while 5% (0.05) to 10% (0.1) indicated weak evidence in support of alternative hypothesis while above 10% (0.1), no evidence supporting alternative hypothesis. Each of the sustainability attributes, sustainability literacy, transition/uptake and assessment/evaluation were explored individually as above described. The resulting findings are as discussed in detail in the subsequent sections.

4.7.2.1 *P*-value hypothesis testing as to the impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry

Further to Section 4.7.1 above, the study sought to test the pre-set sub-hypothesis 1 (See Section 1.3). This was meant to facilitate inferencing population, Kenyan construction industry, attributes from sample, key interior design professionals in Nairobi City County, attributes. The first attribute was individual impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry. The study had hypothesised, in the null, that the individual impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry was not above average. A *t*-statistic and consequently the corresponding *p*-value computation was made. This was based on the computed sample means and standard deviations from the 5-point Likert scale data.

The findings were – mean (M) = 3.2609; standard deviation (SD) = 0.9985; *t*-statistic ((*t* (45)) = 1.7724 and *p*-value (*p*) = 0.0415. With the *p*-value of 0.0415 being less than the significance level of 0.05, the null hypothesis that the impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry is not above average was rejected. Consequently, the alternative hypothesis that the impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry is above average was accepted. With the *p*-value between 0.01 and 0.05, there was strong evidence supporting the alternative hypothesis that the impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry was above average.

4.7.2.2 *P*-value hypothesis testing as to the impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry

Secondly, the study sought to test the pre-set sub-hypothesis 2 (See Section 1.3). This was to facilitate inferencing population, Kenyan construction industry, attributes from sample, key interior design professionals in Nairobi City County, attributes. The second attribute was on individual impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry. The study had hypothesised, in the null, that the individual impact of sustainability transistion/uptake on sustainable construction compliance in the Kenyan construction industry was not above average. A *t*-statistic and consequently the corresponding *p*-value computation was made. This was based on the computed sample means and standard deviations from the 5-point Likert scale data.

The findings were – M = 3.3043; SD = 1.0082; t (45) = 2.0464 and p = 0.0233. With the resulting *p*-value of 0.0233 being less than the significance level of 0.05, the null hypothesis that the impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry is not above average was rejected. Consequently, the alternative hypothesis that the impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry is above average was accepted. With the *p*-value being between 0.01 and 0.05, there was strong evidence supporting the alternative hypothesis that the impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry was above average.

4.7.2.3 *P*-value hypothesis testing as to the impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry

Thirdly, the study sought to test the pre-set sub-hypothesis 3 (See Section 1.3). This was to facilitate inferencing population, Kenyan construction industry, attributes from sample, key interior design professionals in Nairobi City County, attributes. The third attribute was on individual impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry. The study had hypothesised, in the null, that the individual impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry was not above average. A *t*-statistic and consequently the corresponding *p*-value computation was made. This was based on the computed sample means and standard deviations from the 5-point Likert scale data.

The findings were – M = 3.5435; SD = 1.1097; t (45) = 3.3221 and p = 0.0009. With the p-value of 0.0009 being less than the significance level of 0.05, the null hypothesis that the impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry is not above average was rejected. Consequently, the alternative hypothesis that the impact of sustainability assessment/evaluation on sustainability compliance in the Kenyan construction industry is above average was accepted. With the p-value being below 0.01, there was overwhelming evidence supporting the alternative hypothesis that the impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry was above average.

4.7.2.4 Hypothesis testing as to the joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in the Kenyan construction industry

Lastly, the study sought to test the pre-set main hypothesis (See Section 1.3). This was to facilitate inferencing population, Kenyan construction industry, attributes from sample, key interior design professionals in Nairobi City County, attributes. The attributes were on joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in the Kenyan construction industry. The study had hypothesised, in the null, that the joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in the Kenyan construction industry was not above average.

Findings in Sections 4.7.2.1 – 4.7.2.3 above had all the null hypotheses rejected and the respective alternative hypotheses accepted. In line with Section 1.3 and as postulated by Leedy & Ormrod (2005), the null hypothesis that the joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in the Kenyan construction industry is not above average was rejected. Consequently, the alternative hypothesis that the joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainability compliance in the Kenyan construction industry is above average was accepted.

4.8 Challenges Encountered During Data Collection

The main challenge encountered during the data collection phase of this research study was that data collection was done in December 2018 and was partly affected by delayed submission of filled questionnaires by respondents owing to the holiday. This was because a substantial proportion of the respondents had travelled or were travelling for the Christmas and New Year holiday celebrations. To counter this limitation, the researcher extended the data collection deadline to mid - January 2019 to maximize on response rate.

4.9 Conclusion

For the valid responses of 46 out of 60, this chapter outlined data analysis findings including discussion and presentation of these findings. Data analysis took a bi-pronged approach, descriptive statistics to classify, summarize and explain the collected data and inferential statistics to facilitate deduction of population attributes from the samples attributes. For descriptive statistics, the study employed frequencies, percentages, mean and standard deviation computations. On the other hand, and for inferential statistics, the data was analysed using *p*-value approach to hypothesis testing using *t*-statistic since the population standard deviations and means were unknown. Study data was presented in form of tables, pie-charts and bar-graphs. Chapter 5 hereafter, summarizes the findings in relation to the pre-set study objectives and hypotheses. In addition, the chapter provides conclusions associated with the findings including highlighting areas that the study points to regarding future research.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study set-out to establish the impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance in the Kenyan construction industry individually and jointly. This chapter presents summary of the study findings, conclusions, recommendations and areas proposed for future research. The chapter is structured in line with the study objectives and hypotheses sequentially. The objectives were to establish the extent of sustainability literacy, transition/uptake and assessment/evaluation by key interior design project professionals in Nairobi City County. Additionally, the study sought to test the hypotheses, in the alternative, that the individual and joint impact of independent variables on dependent variable (As identified in Section 2.7) in the Kenyan construction industry was above average.

5.2 Summary of Study Findings

The findings of this study are summarized in line with the pre-set four study objectives (See Section 1.5) as outlined below:

5.2.1 Objective One: Extent of Sustainability Literacy in the Kenyan Construction Industry as a Key Contributor to Sustainable Construction Compliance

This objective sought to establish the levels of sustainability literacy levels in the Kenyan construction industry. From the findings in Chapter 4, the respondents registered an average understanding level of sustainable construction practices (Economic, environmental and social). However, individually, the three sustainable construction dimensions ranked as economic, social and environmental in a descending order of understanding levels.

On this objective, the researcher further sought to establish if key considerations in interior design projects are in line with the established understanding levels. The findings showed that the respondents' key sustainable considerations were social, environment and economic

benefits in a decreasing order of consideration. This indicates a mismatch between the sustainable construction practice understanding/literacy levels and key sustainable construction considerations in interior design projects.

Additionally, as a supporting question to the objective, the study sought to establish key sustainability learning avenues available to the construction industry. It was observed that the avenues ranked as informal learning, construction professional association influence and collaboration amongst firms jointly, formal learning, standard sustainability approaches, sustainability related legislation and policies jointly and lastly construction trade associations influence in a descending order of contribution to sustainable construction literacy levels.

Lastly, the study had hypothesized, in the alternative, that the impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry was above average. The findings of the studies did not accept the null hypothesis and thus was in support of the alternative hypothesis. The study accepted the alternative hypothesis that impact of sustainability literacy in promoting sustainable construction compliance in the Kenyan construction industry was above average. The study findings strongly supported this alternative hypothesis with the *p*-value being between 0.01 - 0.05.

5.2.2 Objective Two: Extent of Sustainability Transition/Uptake in the Kenyan Construction Industry as a Key Contributor to Sustainable Construction Compliance

As the second study objective, the study sought to establish the extent of sustainability transition/uptake in the Kenyan construction industry. Generally, the respondents ranked the overall uptake of the three dimensions of sustainability (Economic, environmental and social) as average. For the individual dimensions of sustainable construction, the findings showed that the respondents' ranked the uptake levels as social, environment and economic in a decreasing order of uptake levels. This was consistent with the ranking of key considerations in interior design projects as highlighted in Section 5.2.1.

On this objective, the study further sought to establish the key drivers attributed to the established transition/uptake levels. These were ranked as organization related drivers, stakeholder related drivers, economic related drivers and management related drivers in order of decreasing influence. Lastly the study also set-out to establish the barriers that were

impeding improved uptake of sustainable construction practices in the Kenyan construction industry. The respondents ranked these as economic related barriers, professional/capacity related barriers, technology related barriers and societal/cultural related barriers in order of decreasing influence.

Lastly, the study had hypothesized, in the alternative, that the impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry was above average. The findings of the study did not accept the null hypothesis and thus was in support of the alternative hypothesis. The study accepted the alternative hypothesis that extent of sustainability transition/uptake in promoting sustainable construction in the Kenyan construction industry was above average. The study findings strongly supported this hypothesis with the *p*-value being between 0.01 - 0.05.

5.2.3 Objective Three: Extent of Sustainability Assessment/Evaluation in the Kenyan Construction Industry as a Key Contributor to Sustainable Construction Compliance

On this objective, firstly, the study sought to establish the extent to which respondent's assessed/evaluated sustainable construction practices in the Kenyan construction industry. An overwhelming majority of the respondents did not assess/evaluate sustainable construction in typical interior design projects and gave a wide array of reasons thereof.

Additionally, the study sought to establish familiarity of respondents with sustainable construction assessment/evaluation standards and/or tools in the Kenyan construction industry. This ranked a below-average score from the study respondents. For the three dimensions the ranking was social aspects assessment standards/tools, environmental aspects assessment standards/tools and economic aspects assessment standards/tools in order of decreasing familiarity levels.

The study also set-out to assess the extent to which respondents are familiar with operational measures of value for sustainability attributes. The respondents were indifferent indicating an average familiarity level with operational measures of value for sustainability attributes. Lastly, the study sought to establish respondent's familiarity levels with any sustainable construction framework assessing the three dimensions of sustainability jointly. An overwhelming majority of the respondents were not familiar with such an assessment framework.

The study had hypothesized, in the alternative, that the impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry was above average. The findings of the study did not accept the null hypothesis and thus was in support of the alternative hypothesis. The study accepted the alternative hypothesis that extent of sustainability assessment/evaluation in promoting sustainable construction compliance in the Kenyan construction industry was above average. The study findings overwhelmingly supported this hypothesis with the *p*-value being less than 0.01.

5.2.4 Objective Four: Joint Impact of Sustainability Literacy, Transition/Uptake and Assessment/Evaluation on Sustainable Construction Compliance in the Kenyan Construction Industry

As postulated by Leedy & Ormrod (2005), the study had a fourth hypothesis was to be accepted only when the three number sub-hypothesis in Sections 5.2.1, 5.2.2 and 5.2.3 above were accepted. Data analysis results reveal that the study fails to accept the null hypothesis for the three sub-hypotheses above and as such consequently fails to accept the null hypothesis for the main hypothesis. As such, the study accepted the alternative hypothesis, for the main hypothesis that jointly, sustainability literacy, transition/uptake and assessment/evaluation jointly have an above average impact on sustainable construction compliance in the Kenyan construction industry.

The above summarized findings are as shown in Table 5.1 below:

Table 5.1: Impacts of Sustainability Assessment/Evaluation on Sustainable Construction Compliance in the Kenyan Construction Industry

Research objectives	Hypotheses	Hypotheses test results
Objective 1: To establish the extent of sustainability literacy as a key contributor to sustainable construction compliance	**Sub-Hypothesis 1:** The impact of sustainability literacy on sustainable construction compliance is above average (Alternative hypothesis, H_A)	The null hypothesis, H_0, was rejected and the alternative hypothesis, H_A, was accepted

Objective 2: To establish the extent of sustainability transition/uptake as a key contributor to sustainable construction compliance	**Sub-Hypothesis 2:** The impact of sustainability transition/uptake on sustainable construction compliance is above average (Alternative hypothesis, H_A)	The null hypothesis, H_0, was rejected and the alternative hypothesis, H_A, was accepted
Objective 3: To establish the extent of sustainability assessment/evaluation as a key contributor to sustainable construction compliance	**Sub-Hypothesis 3:** The impact of sustainability assessment/evaluation on sustainable construction compliance is above average (Alternative hypothesis, H_A)	The null hypothesis, H_0, was rejected and the alternative hypothesis, H_A, was accepted
Objective 4: To establish the joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance	**Main Hypothesis:** The joint impact of sustainability literacy, transition/uptake and assessment/evaluation on sustainable construction compliance is above average (Alternative hypothesis, H_A)	The null hypothesis, H_0, was rejected and the alternative hypothesis, H_A, was accepted

Source: Field Survey, 2019

5.3 Conclusions

This study found out that sustainability literacy is at an average in the Kenyan construction industry. However, there was a mismatch between the sustainability literacy levels for the three dimensions of sustainability and how they rank as key considerations in interior design projects. The established sustainability literacy levels were largely attributed to informal learning, construction professional associations influence, collaboration amongst firms and formal learning approaches amongst other avenues. As established via hypothesis testing, the impact of sustainability literacy on sustainable construction compliance in the Kenyan construction industry was above average.

Sustainable construction registered an average transition/uptake level. Social sustainability registered the highest uptake, followed by environmental sustainability and lastly economic sustainability. Organization related drivers, stakeholder related drivers, economic related drivers and management related drivers were identified as key driver categories attributed to the established sustainable construction uptake levels. On the other hand, economic related, professional/capacity related barriers, technology related barriers and societal/cultural related barriers were found out to be the key impediments to uptake of sustainable construction practices in the Kenyan construction industry. Through hypothesis testing, it was established that the impact of sustainability transition/uptake on sustainable construction compliance in the Kenyan construction industry was above average.

An overwhelming majority of construction practitioners did not typically assess/evaluate sustainable construction in the Kenya. They additionally registered a below average familiarity with sustainable construction assessment/evaluation standards, methods and/or tools. Despite that, the familiarity levels were comparatively high for social aspects, followed by environmental aspects and lowest for economic aspects of sustainable construction. A substantial proportion of the respondents were not aware of applicable operational measures of value for sustainable construction attributes. Lastly an overwhelming majority of the respondents were not familiar with any sustainable construction assessment framework covering the three dimensions of sustainability. However, as evidenced through hypothesis testing, the impact of sustainability assessment/evaluation on sustainable construction compliance in the Kenyan construction industry was found to be above average.

The study concluded that jointly, sustainable construction literacy, transition/uptake and assessment/evaluation have an above average impact on sustainable construction compliance in the Kenyan construction industry.

5.4 Recommendations for Policy and Practice

From the study findings, the following outlined are the resulting recommendations for policy and practice:

i. The study established that there is a mismatch between sustainable construction literacy levels and key sustainable construction considerations. As such, this study recommends the need to have sustainable construction literacy drives tuned to fit the peculiarities of

the various construction industry market segments. This shall ensure that such drives are comparatively effective in informing practice;

ii. Additionally, the study found out that the impact of sustainable construction standard approaches such as BREEAM, legislation, policies and construction trade association's influence as sustainable construction learning avenues was below average. This study thus recommends that these avenues need to be leveraged for improved sustainable construction literacy levels;

iii. From the findings, it was established that sustainable construction uptake levels for the Kenyan construction industry were average. This implies significant room for improvement. Consequently, this study recommends the need to leverage organization related drivers, stakeholder related drivers, economic related drivers and management related drivers in a bid to improve the uptake levels;

iv. With the study findings indicating an average uptake of sustainable construction practices, there is an implied need to suppress barriers to sustainable construction practices uptake. This study recommends development of appropriate approaches to counter the effects of economic related barriers, professional/capacity related barriers, technology related barriers and societal/cultural related barriers;

v. Additionally, the study established that a significant proportion of the respondents did not assess sustainability in their construction projects and were not familiar with assessment standards and tools. This study recommends that there is need for training for construction industry practitioners to improve their familiarity with sustainable construction assessment standards, methods and tools in a bid to foster improved sustainable construction assessment levels; and

vi. Lastly, a significant proportion of the respondents were not aware of any sustainability assessment framework covering the three dimensions of sustainability for construction projects. This study recommends that there is need for development of such frameworks, adapted to local conditions, for the various market segments of the construction industry. This is in a bid to encourage improved sustainable construction assessment levels.

5.5 Suggestions for Further Research

The following outlined are the suggestions advanced by this study for future research:

i. A similar study should be conducted sampling from industry practitioners drawn from the general architectural and/or interior design market segment of the construction industry in different countries to assess variations in responses, if any;

ii. Additionally, further studies can consider the impact of other variables, excluding sustainable literacy, transition and assessment, on sustainable construction compliance in the construction industry. This study proposes the impact of individual project stakeholders, stakeholders at the firm level and statutory regulators on sustainable construction compliance in the construction industry;

iii. Also, further studies can be conducted on weighting of the sustainable construction assessment framework, for the three dimensions of sustainability, advanced in this study. This is aimed at developing a sustainable construction assessment framework cognizant of the local conditions; and

iv. Lastly, future research can consider developing a framework for sustainable construction learning to guide sustainability literacy. Such a framework can be developed through collaborative research between industry stakeholders and the academia such as Universities that are training future industry practitioners as well as those conducting research on sustainability issues.

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APPENDICES

Appendix 1: Research Authorization Application Letter

University of Nairobi
P.O. Box 30197-00100
Nairobi

20th November 2018

To:
The Chairperson
Department of Real Estate and Construction Management
University of Nairobi
P.O. Box 30197-00100
Nairobi

Dear Sir/Madam,

RE: APPLICATION FOR ACADEMIC RESEARCH LETTER OF INTRODUCTION

I am a final year master's degree student pursuing Master of Arts (M.A) in Construction Management at University of Nairobi. As part of the degree course requirements, I am expected to undertake a research in the said area of specialization.

As such, I am writing to apply for a letter of introduction to facilitate data collection of my study titled: **"An Investigation on Sustainability Compliance in the Kenyan Construction Industry (A Perspective of Interior Design Stakeholders in Nairobi County)".** This study targets Interior Designers/Architects, Quantity Surveyors, Electrical Engineers, Mechanical Engineers and Fit-Out contractors in Nairobi City County.

Looking forward to your favorable response.

Yours Faithfully,

Joseph S. Kamau

Student Registration Number: B53/89238/2016

Appendix 2: Research Authorization Letter

UNIVERSITY OF NAIROBI
DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT
P.O. Box 30197, 00100 Nairobi, KENYA, ***Tel: No. +254-020-491 3531***
E-mail: *dept-recm@uonbi.ac.ke*

Ref: B53/89238/2016 **Date:** 19th February, 2019

To Whom It May Concern

Dear Sir/Madam,

RE: RESEARCH LETTER FOR JOSEPH S. KAMAU

This is to confirm that the above named is a second year student in the Department of Real Estate & Construction Management pursuing a course leading to the degree of M.A. Construction Management.

He is carrying out a research entitled "***An Investigation on Sustainability Compliance in Kenyan Construction Industry. (A Perspective of Interior Design Stakeholders in Nairobi County***" in partial fulfillment of the requirements for the degree programme.

The purpose of this letter is to request you to allow him access to any kind of material he may require to complete his research. The information will be used for research purposes only.

CHAIRMAN
DEPARTMENT OF REAL ESTATE
AND CONSTRUCTION MANAGEMENT
UNIVERSITY OF NAIROBI

Isabella N. Wachira -Towey (PhD),
Chair & Senior Lecturer
Department of Real Estate & Construction Management

Appendix 3: Questionnaire Cover Letter

University of Nairobi
P.O. Box 30197-00100
Nairobi

5th December 2018

To whom it may concern

Dear Sir/Madam,

RE: RESPONDENTS QUESTIONNAIRE INTRODUCTION

I am a final year master's degree student pursuing Master of Arts (M.A) in Construction Management at University of Nairobi. As part of the degree course requirements, I am expected to undertake research in that area of specialization.

You have been identified for the purposes of this research. The title of this study is:

"An Investigation on Sustainability Compliance in the Kenyan Construction Industry (A Perspective of Key Interior Design Professionals in Nairobi City County)".

Your participation and/or assistance will be highly appreciated. The information so given will be for academic purposes only and thus will be treated with utmost confidentiality.

Yours Faithfully,

Joseph S. Kamau
Student Registration Number: B53/89238/2016
Department of Real Estate and Construction Management

Appendix 4: Questionnaire to Respondents

Questionnaire for Interior Designers/Architects, Electrical Engineers, Mechanical Engineers, Quantity Surveyors and Fit-Out Contractors in Interior Design Projects

Questionnaire Number : ……

Date Issued to the Respondent : ……

Date Received from the Respondent : ……

Part 1: Key Definitions of Used Terms

Sustainability - Development ability of present generation being able to meet their own needs (Intra-generational equity) without compromising the ability of future generations to meet their own needs (Inter-generational equity) covering the associated economic, environmental and social aspects (Brundtland, 1987 & Carboni et al., 2018).

Sustainability Literacy - Mastery/proficiency of sustainability skills and knowledge aimed at fostering practices that ensure the planet meets the needs of the current generation without compromising the ability of future generations to do so (Dale & Newman, 2005 & Murray & Congrave, 2007).

Sustainability Transition/Uptake - Multi-faceted, long term change of established social-technical set-ups to comparatively sustainable consumption and production modalities involving change in socio-technical systems and the same time changing the criteria with which the various stakeholders judge products, services and systems (Markard et al., 2012 & Kemp & Lente, 2011).

Sustainability Assessment/Evaluation - Any process geared at advancing understanding, contextualization and influencing uptake of sustainability to steer associated decision making towards managing sustainability (economic, environmental and social) problems and issues (Waas et al., 2014).

Sustainable Construction - The total process that ensures and maintains balance between the built and natural environments (environmental considerations) while at the same time upholding human dignity (social considerations) and ensuring economic equity amongst the populace (economic considerations) (Du Plessis (2002).

Part 2: Respondents Profile

1. Please tick (✓) below your typical role in interior design projects:

- ☐ Interior designer/Architect
- ☐ Electrical engineer
- ☐ Mechanical engineer
- ☐ Quantity surveyor
- ☐ Fit-out contractor

2. Please tick (✓) below your corresponding experience in interior design projects:

- ☐ < 1 year
- ☐ 1-2 years
- ☐ 3-4 years
- ☐ > Over 5 years

3. Please tick (✓) below the number of interior design projects that you are currently handling:

- ☐ < 2 projects
- ☐ 2-3 projects
- ☐ 4-5 projects
- ☐ > Over 5 projects

4. What is your highest level of education? – Tick (✓) below as appropriate:

- ☐ Primary level and below
- ☐ Secondary level
- ☐ College level
- ☐ University level

Part 3: Sustainability Literacy in the Kenyan Construction Industry – Independent Variable 1

5. Please rate your overall understanding of sustainable construction practices in interior design projects – Tick (✓) below as appropriate

   Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Practices	**Responses**				
	1	**2**	**3**	**4**	**5**
Economic related practices such as ensuring lifecycle cost efficiency					
Environmental related practices such as ensuring reduction of project related emissions and minimizing waste					

Social related practices such as ensuring fair labor practices and access by the physically challenged					

6. Please rate your key sustainability considerations in a typical interior design project – Tick (✓) below as appropriate

   Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Benefit Categories	**Responses**				
	1	**2**	**3**	**4**	**5**
Economic benefits such as avoiding increased exposure to green taxes, safeguarding reputation, avoiding resistance for pressure groups, rationalized operating and maintenance costs and increased revenue which can be realized through sale or rent of constructed facilities					
Environmental benefits such as improved quality of the surroundings and rationalized use of natural resources and energy					
Social benefits such as health and safety, enhanced wellbeing, reducing abseentism, reduced rate of employee turnover and reduced liabilities					

7. Please rate the sources of information on sustainable construction practices in interior design projects that you attribute to your current sustainability awareness levels – Tick (✓) below as appropriate

   Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Learning Avenues	**Responses**				
	1	**2**	**3**	**4**	**5**
Construction professionals' associations influence through CPDs and degree courses					
Construction trade associations influence such as KABCEC stakeholder engagement forums					
Standard sustainability approaches such as BREEAM and LEED					
Formal learning (formal curriculum-based education)					

Informal learning as apprenticeship, industrial attachment and online sources					
Sustainability related legislation such as EMCA (1999) for environmental considerations and Employment Act (2007) for social considerations – Laws of Kenya					
Sustainability related policies					
Collaboration amongst firms					

Part 4: Sustainability Transition/Uptake in the Kenyan Construction Industry – Independent Variable 2

8. Please rank the uptake levels of sustainable construction practices in interior design projects – Tick (✓) below as appropriate

   Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Practices Categories	**Responses**				
	1	**2**	**3**	**4**	**5**
Economic related practices such as ensuring lifecycle cost efficiency					
Environmental related practices such as ensuring reduction of project related emissions and minimizing waste					
Social related practices such as ensuring fair labor practices and access by the physically challenged					

9. Please rank the factors that you attribute to the current sustainable construction practices uptake in interior design projects – Tick (✓) below as appropriate

   Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Drivers	**Responses**				
	1	**2**	**3**	**4**	**5**
Stakeholder related drivers such as pressure from clients, pressure from employees, pressure from other stakeholders, legislation and enhanced indoor environment					
Organizational related drivers such as corporate image, organization ethos, alignment of organization (formal and					

informal) towards sustainability and design process re-engineering					
Management related drivers such as management commitment, training and centralization/integration of efforts towards sustainability					
Economic related drivers such as boosting business performance, lifecycle cost reduction, avoiding sustainability related penalties, enhancing productivity of built assets, innovative products and appropriate incentives					

10. Please rank the barriers that impede effective adoption of sustainable construction practices in interior design projects – Tick (✓) below as appropriate

    Use the key: 1 = strongly disagree, 2 = disagree, 3 = indifferent, 4 = agree and 5 = strongly agree

Sustainable Construction Barriers	**Responses**				
	1	**2**	**3**	**4**	**5**
Economic related barriers such as increased project cost, increased project duration, uncertain economic environment, poverty, low urban development and lack of government support					
Professional/capacity related barriers such as lack of appropriate knowledge/information, lack of sustainable construction materials, lack of appropriate sustainability evaluation tools, lack of appropriate building codes and regulations, lack of appropriate professional expertise and inefficient coordination between design and construction teams					
Societal/cultural related barriers such as lack of interest, lack of incentives, resistance to change, limited awareness and lack of demand					
Technology related barriers such as uncertainty of sustainability technology performance, failure to understand sustainable technology work, inadequate technology specifications on sustainable approaches and unavailability of appropriate sustainability technologies					

Part 5: Sustainability Assessment/Evaluation in the Kenyan Construction Industry – Independent Variable 3

11. Do you typically assess/evaluate sustainability (Economic, environmental and social) performance over the lifecycle of a typical interior design project – Tick (✓) below as appropriate

    ☐ **Yes**

    ☐ **No**, If you answer is No, what are the reasons?

……

……

……

12. Please rank your familiarity with sustainability assessment standards and/or tools in interior design projects – Tick (✓) below as appropriate

    Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Assessment Standards and/or Tools Categories	**Responses**				
	1	**2**	**3**	**4**	**5**
Economic aspects assessment standards and/or tools such as Cost Reference Model (Netherlands), Lifecycle (UK), GaBi3 (Germany) and BLCC, QuickBLCC & LCCID (USA)					
Environmental aspects assessment standards and/or tools such as GBTool (International), LEED & SpiRiT (USA), Equer (France), BREEAM (UK), OGIP (Switzerland) and H-K Beam (Hong Kong)					
Social aspects assessment standards and/or tools such as social surveys, questionnaires, interviews and statistics such as census data, social-cost benefit analysis, marketing information and field research					

13. Please rate the following statements as "Yes" or "No" – Tick (✓) below as appropriate

Sustainability Indicator Purposes	**Responses**	
	Yes	**No**
I have information well-structured for sustainability decision making		

I am aware of how to practically apply sustainability in interior design projects		
There is substantial shift in attitudes, views and knowledge towards sustainability in interior design projects		
I am aware of how to measure the performance of the various sustainability aspects in construction projects		
I am aware of the various information needs regarding sustainability in interior design projects and how to fill them		

14. Are you familiar with any framework that guides sustainability assessment of the three dimensions of sustainability (Economic, environmental and social aspects) jointly in interior design projects? – Tick (✓) below as appropriate

    ☐ Yes

    ☐ No

Part 6: Sustainability Compliance in the Kenyan Construction Industry – Dependent Variable

15. Rate the following as to their effectiveness in promoting sustainability compliance in the Kenyan construction industry – Tick (✓) below as appropriate

    Use the key: 1 = lowest, 2 = low, 3 = average, 4 = good and 5 = very good

Sustainable Construction Practices Aspects	**Responses**				
	1	**2**	**3**	**4**	**5**
Sustainability Literacy					
Sustainability Transition/Uptake					
Sustainability Assessment/Evaluation					

End of questionnaire.

Thank you for your time and cooperation.