SELINUS UNIVERSITY
OF SCIENCES AND LITERATURE

Contemporary challenges of sustainability and regeneration in the Construction Industry

By Anthony Obododike Ekwuno

A DISSERTATION

Presented to the Department of
Construction Management
program at Selinus University

Faculty of Engineering and Technology
in fulfillment of the requirements
for the degree of Doctor of Philosophy
in Construction Management

2024

Abstract

The building industry contributes significantly to national economic and social growth. Nonetheless, the industry has had a substantial environmental impact. As a result, the building industry has faced a tremendous challenge in ensuring its sustainability. Globally, the construction sector is not extremely productive. This study was important because of its academic and societal impacts. The findings had a discernible impact on the advancement of knowledge in academia and would also contribute to the body of knowledge on using cutting-edge materials in the construction sector. It would be referenced in the academic work of upcoming scholars and researchers. It would also improve academics' and practitioners' understanding of the management and implementation of sustainability and direct stakeholders toward a quick adoption of sustainability ideas and technology in the future. This study took a pragmatic approach and a top-down methodology in examining the literature on sustainable development. A mixed-method research design was used which consisted of a survey and a semi structured interview to gather the opinions of the major stakeholders; namely client, consultant, and contractor. In general, empirical evidence revealed that the most significant challenges associated with environmental management were cost increases, a lack of environmental awareness, a lack of environmental education and training, a scarcity of green materials and components, a lack of understanding of environmental legislation, poor communication, and a lack of commitment. The benefits that accrued from the adoption of sustainable construction practices in accordance with the results included compliance with the environmental legislation and regulations, contribution to the environmental protection, and improvement of staff working conditions.

Keywords: Construction Projects, Environment, Mitigation, Sustainability Challenges

Acknowledgement

I am grateful to the Almighty God for His Mercy and Direction throughout this study. My heartfelt gratitude goes to all of the lecturers at Selinus University for helping to make this wonderful journey a success. I would like to thank everyone who helped complete the questionnaires for this study. Special thanks go to my research supervisor, Professor Salvatore Fava PhD, and the other members of the supervisory committee for investing significant time to ensuring the success of this work. Finally, I'd like to express my heartfelt gratitude to my family members, Mrs Elizabeth Okwuchukwu Ekwuno, Miss Cynthia Obianuju Ekwuno, Master Gideon Chimdindu Ekwuno, Master Victor Ifechukwu Ekwuno, and Master Wisdom Chigozie Ekwuno, for their ongoing prayers for the successful completion of this study. I sincerely appreciate everyone's contributions to my studies.

List of Tables

List of Figures

Interpretation of Abbreviations

S/No	Abbreviation	Interpretation
1	AEC	Architecture, Engineering, and Construction
2	BIM	Building Information Modelling
3	BITC	Business in the Community
4	BNG	Biodiversity Net Gain
5	CO2	Carbon Dioxide
6	CBO	Community-Based Organizations
7	CIDB	Construction Industry Development Board
8	CNSG	Computational Narrative Semi-Fiction Generation
9	COP	Conference of Parties
10	CR	Community Relations
11	CSF	Critical Success Factor
12	CSR	Company's Social Responsibility
13	DfE	Design for Environment
14	EDA	Economic Development Administration
15	EDO	Economic Development Organisations
16	EMS	Environmental Management System
17	ESG	Environmental, Social, and Governance
18	EU	European Union
19	GCI	Green Construction Industry
20	GDP	Gross Domestic Product
21	GEF	Global Environment Facility
22	GFCF	Gross Fixed Capital Formation
23	HR	Human Resources
24	IBS	Industrialized Building Systems
25	IEQ	Indoor Environmental Quality
26	IMF	International Monetary Fund
27	IPCC	Intergovernmental Panel on Climate Change
28	ISO	International Organization for Standardization
29	KM	Knowledge Management
30	KWS	Knowledge Worker System

31	LCA	Life Cycle Assessment
32	LCC	Life Cycle Costing
33	LEED	Leadership in Energy and Environmental Design
34	NGO	Non-Governmental Organization
35	NRDC	Natural Resource Defence Council
36	OECD	The Organization for Economic Cooperation and Development
37	O&M	Operation and Maintenance
38	RDL	Regional Data Libraries
39	RIBA	Royal Institute of British Architects
40	SCP	Sustainable Consumption and Production
41	SD	Sustainable Development
42	SDG	Sustainable Development Goal
43	SHD	Sustainable Human Development
44	SME	Small to Medium Enterprise
45	SOE	State-Owned Entities
46	TC	Technical Capacity
47	TEDI	Thermal Energy Demand Intensity
48	TEUI	Total Energy Use Intensity
49	TIF	Tax Increment Financing
50	USEPA	US Environmental Protection Agency
51	USGBC	US Green Building Council
52	VM	Value Management
53	VOC	Volatile Organic Compounds
54	WCED	The United Nations World Commission on Environment and Development
55	WTO	World Trade Organization

Table of contents

Contemporary Challenges of Sustainability and Regeneration in the Construction Industry

Chapter 1

Introduction

1.1. Introduction

Sustainability has become a vital tool in the battle against social, environmental, and economic issues as well as climate change. The verb "to sustain," which essentially means to uphold and retain anything, is where the word sustainability originates. Human idea is to work to preserve and safeguard life as it is on Earth (Ashford & Hall 2011). In light of this idea, Sustainability could be defined as a style of life that causes as little harm as possible to other living beings or the environment.

Minerals and other natural resources are extensively used by the construction sector (Yurdakul & Kazan 2020). The necessity and significance of sustainability in construction have come under intense debate as a result of growing worries about global warming and the limited nature of resources (Collins et al. 2003; Liu et al. 2022). The demand on construction enterprises to lessen their environmental impact grows as a result of this widespread knowledge. To reduce energy use and toxic waste, sustainable construction projects use recyclable and renewable materials (Meena et al. 2022).

Reducing the industry's environmental impact is the main objective of utilizing novel materials (Koutsogiannis 2018; Jackson 2021). A more long-term and economical solution is more in demand due to the clear effects of global warming (Koutsogiannis 2018; Jackson 2021). Significant environmental harm has already been done by the construction industry. Construction businesses and important decision-makers have prioritized finding a solution to this problem in order to reduce the use of raw materials and natural resources as well as carbon footprints (Simpeh[1] and Smallwood[2] 2018). Many companies have started to take the necessary measures toward planning, remodelling, or building facilities in compliance with environmental laws and sustainable practices in order to attain the sustainability development

(Rowe and Davis 2011). With a rise in interest in sustainability and energy saving over the past ten years, new technology, material, and practice breakthroughs have developed to permit and promote overall efficiency.

Using cutting-edge building materials in built environment can reduce waste and air pollution while also increasing prospects for reuse, according to Meena et al. (2022. This method will greatly reduce the requirement for raw materials while greatly improving the performance and efficiency of the construction process. Because hybrid structures are so environmentally friendly, they are beneficial for the environment (Rowe and Davis 2011). Being inventive is the best approach to staying current and competitive. The construction company will lag behind if they don't keep up with technical improvements (IEA 2019). The greatest approach to stay competitive is to provide clients cutting-edge construction materials. The clients' projects will benefit if the greatest technology available is given to them (Meena et al., 2022).

The idea of sustainability was developed in response to rising concerns over the damaging effects of technology and the degree of environmental damage caused by human activity during the previous 200 years (Khataybeha, Subbarinia, and Shurmana 2010).. Following World War II, nations all over the world adopted sustainability development as their guiding concept (Khataybeha, Subbarinia, and Shurmana, 2010). Nations adopt contemporary scientific and technological advancements without thoroughly evaluating the broader consequences for the planet's future. According to Cordano & Frieze (2000), humankind's obsession with material luxuries has led to the quick creation of a plethora of issues, including increased pollution, biodiversity loss, human rights violations, inefficient energy use, global warming, and a growing wealth disparity. Global leaders are forced by these effects on the environment to look for answers in order to save the planet's natural resources, advance prosperity through opportunity equity, and lessen poverty, according to Brian (2015).

1.2. Problem Statement

The world has become more globalized, and it is obvious that to address the tremendous environmental pressure that human activity is putting on the globe, sustainable solutions must be put forth and need to be finished quickly. Not only is this alteration feasible, but it is also required. To maximize the reuse of waste through its recovery or use as initial raw material,

there is a need to recognize, define, and apply in a strategic manner all those economic and social activities, initiatives, and models that (1) aim to reduce the use of raw materials produced as efficiently as possible using renewable energies and (2) maximize the reuse of waste and prevent sustainability challenges.

Globally, the construction sector is not extremely productive (Barbosa et al., 2017). Despite being one of the biggest in the global economy, productivity has increased on average by 1% per year over the past 20 years, according to Duncan, Kingi, and Brunsdon (2018). In contrast, the manufacturing sector's productivity rose by 3.6% annually during the same period (Barbosa et al., 2017). The construction industry needs to dramatically boost productivity to keep up with the anticipated demand for new projects. Productivity growth depends on industry innovation (Duncan, Kingi, & Brunsdon 2018). For innovation to satisfy demand, the industry must change. The industry runs the danger of losing out on the chance to take advantage of this need without the transformation that makes it possible for creative new practices and methodologies (Duncan, Kingi, & Brunsdon (2018). The need for change in the construction industry has been amply highlighted in some papers (Barbosa et al., 2017). These analyses suggest changes to specific areas of practice throughout the industry's value chain, with a focus on boosting productivity to satisfy rising construction demand. The use of innovative materials is advised for the construction sector, according to Duncan, Kingi, and Brunsdon (2018), to increase productivity.

The consequences of our expanding and wasteful resource consumption are poverty, pollution, ill health, biodiversity loss, and climate change. These issues are interconnected and often exacerbate each other.. Humans have relied on the natural resources of the planet for millennia to survive; therefore it makes sense that these resources are limited. Price increases, hardships, and conflicts can result from scarcity. Additionally, it results in greater efforts to locate new resources, frequently with unanticipated or unusual outcomes. The environmental and social challenges are massive in scope. To achieve sustainable development, fundamental changes in how things are done are required. Beyond only optimizing resource consumption, this will also need to involve dematerialization, cradle-to-cradle manufacturing methods, and a shift from products to services.

1.3. Research Questions

This study had fourteen research questions that will draw on knowledge from social and educational science and professional learning theory to address the research problems and would be examined through field data analysis and interpretation.

1.3.1. How the economic benefits of sustainability for a greener built environment are compared to traditional building systems?

1.3.2. What are the perceptions of stakeholders regarding sustainable construction, sustainable economy, and green economy?

1.3.3. What role do stakeholder perspectives play in the adoption of innovative sustainable construction**?**

1.3.4. How can economic incentives be leveraged to promote the use of sustainable construction?

1.3.5. To what extent do economic benefits influence the decision-making process of building owners and property managers when considering the use of innovative materials for a greener built environment?

1.3.6. Why is corporate sustainability necessary?

1.3.7. How do regulatory bodies influence the economic benefits?

1.3.8. What are the Strategies to be employed to encourage the use of innovative sustainable construction materials?

1.3.9. What are the sustainable challenges facing the construction industry?

1.3.10. How these sustainable challenges are overcome and designed for a sustainable future?

1.3.11. How does sustainable practice championed at work?

1.3.12. Do we need to be rich to be sustainable?

1.3.13. How can design thinking help with sustainable development?

1.3.14. How do stakeholders compare sustainability and ESG (environment, social, and governance?

1.4. Aims and Objectives of the study

1.4.1. Aims

This study aims to explore the contemporary challenges of sustainability and regeneration in the construction industry

1.4.2. Objectives

a. To explore the economic benefits of sustainability for a greener built environment compared to traditional building systems.

b. To establish the perceptions of stakeholders regarding sustainable construction, sustainable economy, and green economy.

c. To investigate the role stakeholder perspectives, play in the adoption of innovative sustainable construction.

d. To find out how economic incentives can be leveraged to promote the use of sustainable construction.

e. To ascertain what extent economic benefits, influence the decision-making process of building owners and property managers when considering the use of innovative materials for a greener built environment.

f. To establish the necessity for corporate sustainability.

g. To examine how regulatory bodies influence the economic benefits.

h. To investigate the strategies to be employed to encourage the use of innovative sustainable construction materials.

i. To disclose the sustainable challenges facing the construction industry.

j. To explore how these sustainable challenges are overcome and designed for a sustainable future.

k. To verify how sustainable practice are championed at work.

l. To discover if there is any need to be rich to be sustainable.

m. To ascertain how design thinking can help with sustainable development.

n. To investigate how stakeholders compare sustainability and ESG (environment, social, and governance.

1.5. Significance of study

This study is important because of its academic and societal impacts. The findings will have a discernible impact on the advancement of knowledge in academia and will also contribute to the body of knowledge on using cutting-edge materials in the construction sector. It will be referenced in the academic work of upcoming scholars and researchers. It will also improve academics' and practitioners' understanding of the management and implementation of sustainability and direct stakeholders toward a quick adoption of sustainability ideas and technology in the future. The researcher will also gain from an academic award. The study however, will have an economic impact in the sense of money saved, etc. It will also help ecosystems, habitat conservation, and genetic variety in the environment. In addition, the study will add to the body of knowledge by making experts more aware of sustainable construction so that it can be used.

The study's findings also seek to offer creative approaches to implementing sustainability in the construction sector. The thesis will reference works from a range of construction disciplines that have contributed to the body of knowledge on the difficulties and applications of sustainability. This study is significant because it (a) advances theory, (b) promotes practice, and (c) fills gaps in the literature. The goal of this study is to further our understanding of the difficulties and dynamic nature of implementing sustainability. Finding out how stakeholder participation affects the adoption of sustainable practices is the goal of the study. The study's conclusions provide the necessary tools for the stakeholders to create best practices for advancing the sustainable practices of professional educators in the construction industry. The study's contribution to the literature closes a gap in the research by using complexity theory to analyse sustainable practice and its challenges. Little is currently understood about the macro and meso levels of sustainability challenges and mitigation measures that impact sustainable practices. The study will add to the body of knowledge by concentrating on sustainable practices in intricate environments.

1.6. Theoretical framework and conceptual framework

1.6.1. Theoretical framework

According to Smith et al. (1998), sustainable development (SD) is a method of human development in which the use of resources is intended to satisfy human needs while maintaining the sustainability of natural systems and environmental circumstances. The idea of sustainable development (SD) is linked to several aspects of socio-economic development, which tries to ascertain what societies require in order to survive. The Brundtland Commission popularized the term "sustainable development," which refers to the idea that the next generation should have the same level of chances for well-being as the current generation. In other words, sustainable development is defined as "non-decline" in the context of human welfare, which can be measured using human utility, incomes, and consumption levels, depending on the method of analysis (Khataybeha, Subbarinia, and Shurmana 2010).

Broadly speaking, socioeconomic development (SD) focuses on attaining and sustaining economic growth in relation to other socioeconomic development elements. It attempts to satisfy the highest standards of human needs and enhance living circumstances while providing the financial means necessary for environmental preservation (Deniyi, Mohamed, & Rasak 2020). The concept of sustainable development is multifaceted and based on many presumptions in various nations. In recent decades, scholars, governments, and organizations (such as the World Bank, International Monetary Fund (IMF), and World Trade Organization (WTO) have defined the sustainable development approach by considering environmental factors and human living standards (David, 1996).

The integration of economic, social, and environmental issues in decision-making and policy-making at all levels of development aspects is the fundamental concept of sustainable development, according to Adeniyi, Sarajul , & Kolawole (2020) research. This aids in the comprehension of the many facets of sustainable development, their intricate relationships, and the facilitation of policy choices meant to forward the objectives of sustainable development. Almost all conventional areas of economic and governmental activity, including economic planning, agriculture, engineering, health, energy, water, natural resources, industry, education, and the environment, must be involved in the integration process (Adeniyi, Sarajul , & Kolawole 2020).

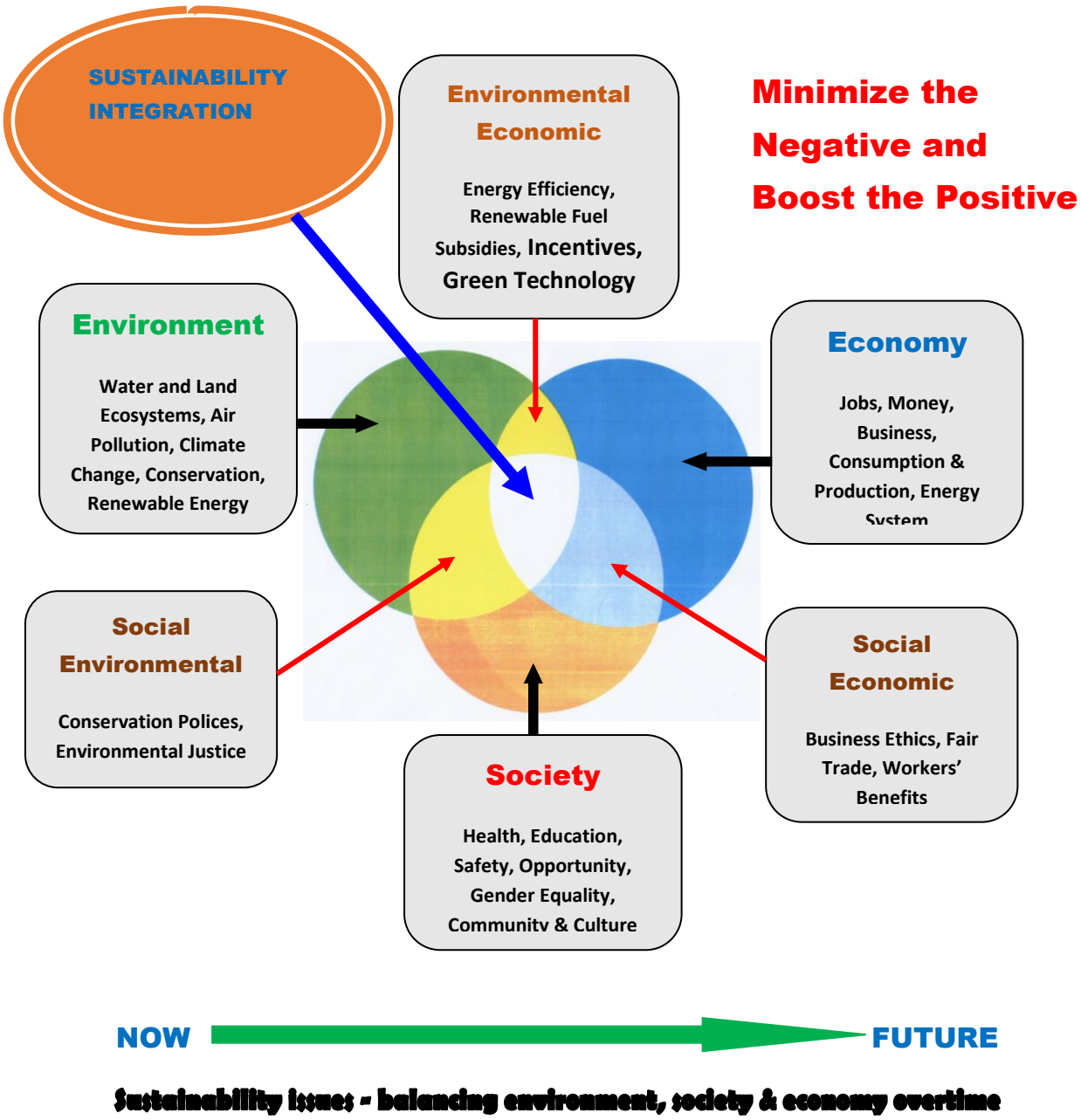
According to several studies by Larsson, Jansson, & Boholm, (2019), the wealthy profit is from population expansion, while the rest of the population bears the consequences of resource depletion, social stress, environmental degradation, and other issues. According to the World Commission on Environment and Development (2011), the two central ideas of sustainable development are the concept of "needs," specifically the basic needs of the world's poor, which should be prioritized, and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet the needs of the present and the future, Costanza (2003) revealed. Sustainable development goes beyond mere economic expansion; it necessitates a shift in the composition of growth, making it less dependent on materials and energy and more impact-equitable, Heintz & Wamelink (2015) indicate. All nations must implement these adjustments as part of a set of policies meant to preserve the amount of ecological capital on hand, enhance income distribution, and lessen the degree of susceptibility to economic downturns (Heintz & Wamelink 2015). According to David (1996), sustainable development (SD) is about attaining the economic growth required to satisfy human needs, raise living standards, and supply the funds required to enable environmental conservation. The two main goals of sustainable development are to create sustainable human institutions that provide security as well as opportunities for social interaction and spiritual development, and a sustainable economy that fairly meets human needs without depleting natural resources or removing waste beyond the capacity of the environment to renew itself. Developing a common vision of a sustainable and desirable society is the most crucial task facing humanity today. Among the most crucial concerns is how to contribute to permanent prosperity within the world's biophysical constraints in a way that is just and equal to all of humanity, from the current generation to the generations to come (Herman, 1992; Costanza, 2003). The long-term preservation of the elements and behaviours that improve the environment's quality is known as environmental sustainability. This factor's measurement highlights the general health and viability of living systems in all of their varied and comprehensive characteristics (Costanza, 2003).

1.6.2. Conceptual framework

The three primary aspects of analysis that form the foundation of this study are environmental protection, social development, and economic growth. The fundamental idea of sustainable development necessitates an integrated, well-balanced study from the three primary perspectives of environmental circumstances, social development, and economic growth. The interaction of those important components is examined using this conceptual framework in an

effort to give a clear definition of sustainability and its effects on the building sector. From the standpoint of economic growth, this component strives to raise the standard of life for the populace by increasing the provision of necessities through increasing the consumption of products and services. Figure 1 below shows the conceptual frame work of analysis.

Fig.1: Conceptual Framework of analysis



The main idea of this thesis is to identify the important factors that are essential for economic growth. This is followed by an analysis of the environmental factors, societal development, and the difficulties and solutions related to these factors. One of the main ideas of this study is the integration of these elements. While environmental issues focus on protecting the environment and ecological systems, Gross Domestic Product (GDP) is used as a standard measure of economic growth. Carbon dioxide emissions are used as a proxy for environmental conditions because they are mostly dependent on changes in air pollution. Income disparity and poverty are utilized as stand-ins for social factors. The percentage of the population living in poverty fell from 45% in 1992 to 26% in 2010, which is regarded as a high level, despite continuous economic growth for more than ten years, since 2000 (Liu et al. 2022). However, the problem of poverty is still pervasive in rural regions (Liu et al. 2022). To guarantee the results of sustainability in development, various spheres must interact, which calls for sound policy and regulation. Sustainability of Social Development and Improvement of Living Conditions, Poverty and income disparity are variables (Smit and Du Toit 2015). The foundation of environmental sustainability is the prevention of pollution and the preservation of the robustness and integrity of natural systems. Whether economic growth contributes to social inequality is debatable. Thus, only when economic growth is allocated toward enhancing social conditions by reducing poverty and minimizing income disparity will it contribute positively to sustainable development (Jackson 2021).

Job creation, skill development, local economic effects, and social investment are among the social dimensions of economic growth's effects. Economic expansion and social advancement are closely related, according to several researches. A notable illustration of this is the research by Yurdakul & Kazan (2020) which claimed that beliefs about the development of basic needs and economic progress are intertwined. According to the study, placing a strong focus on basic requirements would, at least initially, hinder economic growth, which would impede further advancements in the basic needs program (Yurdakul & Kazan 2020).

Social development, by definition, is the process of modifying the social structure within a community. It may also allude to the idea of societal advancement. Social development changes in response to shifts in economic performance. Social justice, which is one of the main principles supporting sustainable development and acknowledges people and their quality of life as a major concern, is one of the most crucial elements to consider when evaluating sustainable social development. To put it succinctly, equality refers to how

inclusive and equitable decisions, opportunities, and resource distribution are created (Adeniyi, Sarajul, & Kolawole 2020).

Measuring the effects of economic expansion on environmental conditions has also become crucial to determining how sustainable a nation is developing Mashwama[1], Thwala[1], Aigvbavboa[1], & Hamma-Adama[2] (2020). For many nations, a high rate of economic growth is regarded as essential to economic development. (Mashwama[1], Thwala[1], Aigvbavboa[1], and Hamma-Adama[2]2020) discover that to restore economic growth and increase the nation's market participation in the global economy, while also lowering social inequality and safeguarding the environment, present a number of obstacles.

In a nutshell, the goal of this conceptual framework is to illustrate how the study's ultimate result may be attained. The nation's socioeconomic development must be well-adjusted between economic growth, social development, and environmental protection are the the three key topics covered in this thesis in order to achieve sustainable development's ultimate goal, Deniyi, Mohamed, & Rasak (2020) revealed. Furthermore, in order to fully and efficiently employ human resources and preserve natural resources, socioeconomic growth must be divided harmoniously among sectors, regional development, and urban and rural development (Kádárová, Durkáčová, Teplická, Kádár 2015).

Chapter 2

Literature review

2.1. Introduction

The purpose of this literature review is to understand and explain what has been published about the use of cutting-edge construction materials for a greener built environment, as well as the benefits and downsides of implementing novel approaches. With a focus on the construction industry, it considers research and policy documents on the adoption of innovative techniques (De Wit 2016). Three issues have been investigated in the literature: (1) introducing new practices into the construction sector, (2) the economic benefits of using novel materials to create a greener built environment, and (3) the challenges of implementing sustainability in the construction industry (De Wit 2016).

This literature study begins by examining the economic benefits of new materials for a greener built environment in order to acquire a broad understanding of the drivers, barriers, and enablers of change. Following an examination of the extent to which economic benefits influence building owners' and property managers' decision-making processes, the article discusses the impact of regulatory bodies on the economic benefits and stakeholder perceptions of innovative sustainable construction, as well as the social and environmental co-benefits associated with the use of innovative materials in construction (Alves et al. 2018).

The final section summarizes the findings of this literature review in respect to each of the study's research objectives. According to Freeman et al. (2010), watching how these findings differ or converge with those from the online poll and workshops would provide a better understanding of how to successfully encourage the adoption of novel ideas in the construction setting.

Economic growth evaluates sustainability through the lens of a consumer-driven culture that sees nature's limited resources as a source of income that prevents catastrophic tragedies (Windapo, 2014). To maintain the foundation of natural resources and their conservation, sustainability must provide economic wealth at the local, regional, and global levels. This fosters financially feasible and successful growth (Smit and Du Toit 2015).

The course of development constantly considers environmental preservation (Porumboiu 2021). It entails incorporating the environmental variable with an ecological approach into all policies and actions, such as conserving and restoring damaged ecosystems and natural spaces, reducing waste production and its dangers, and contributing to the prevention and resolution of global environmental problems. However, sustainability refers to people's ability to thrive while preserving ecosystems and biodiversity (Chikwuado, 2020). Natural resource exploitation is maintained at existing levels without exceeding the carrying capacity limit or compromising the resource's inherent attributes. It seeks to avoid the depletion of finite, difficult, or slow-regenerating resources, as well as the generation of waste and harmful pollutants (Chikwuado 2020).

Rowe and Davis (2011) suggest that sustainability addresses the requirement to increase the general population's quality of life, promote social cohesion (intra-generational equality), and conserve natural resources and environmental quality for future generations. This is based on the ability to advocate for shared interests through democratic and non-exclusive channels, as well as the preservation of the social and cultural network (Mashwama et al. 2019). This should be accomplished by changing individual and community attitudes and behaviors so that people care about one another and value social justice, education, health, peace, and quiet, hence raising and preserving the level of life for future generations (Matheny 2023).

2.2. Economic benefits of sustainability for a greener built environment compared to traditional building systems

According to Abdulrahman et al. (2020), sustainable structures often have reduced annual costs for energy, water, maintenance/repair, churn (rearranging space according to shifting needs), and other operating costs. These lower costs do not have to result in higher upfront prices. There is mounting proof that sustainable buildings bring financial benefits to building operators, owners, and tenants. Generally speaking, sustainable buildings have lower annual costs for energy, water, maintenance/repair, churn (rearranging space due to shifting needs), and other running costs (Abdulrahman et al. 2020).

Sustainability for businesses and nations depends on environmental innovation (Skordoulis et al. 2020). The authors point out that the development of new products can concentrate on offering environmental benefits, such as energy savings, a decline in carbon dioxide

emissions, water savings, improvements in recycling, and a decrease in environmental contamination (Skordoulis at el. 2020). According to Ametepey[1] and Ansah[2] (2014), environmental product innovation is thought to increase a company's production and financial health. Ametepey and Ansah (2014) added that there is a similar association between environmental process innovation and a firm's ability to compete. Environmental innovation could also lessen environmental harm, raise the quality and cost of goods and services, and generate new jobs (Ametepey and Ansah, 2014).

According to Oguntona et al. (2019).the word "sustainable" refers to actions taken with the intention of achieving environmental friendliness. The idea of sustainability was developed to find remedies for the harm that human activity is causing to the environment. The construction industry harmed the environment by producing waste, using natural resources excessively, polluting the air, water, and waste materials, among other things. It involved the overuse of raw materials, which degrades the land, pollutes the air and water, generates a sizable amount of waste, and uses a lot of energy. By creating a sustainable business to complete construction projects, the negative effects of the construction activities could be mitigated. The report maintained that the terms "green building" and "sustainable building" are synonymous. The environment, society, and economy are the three pillars of sustainability and account for the majority of the supportability rating frameworks that have been developed in line with the pillars. Green buildings are more resource-efficient than code-compliant buildings in their use of energy, water, and materials. Compared to conventional buildings, these were designed, constructed, and managed to improve economic, environmental, health, and productivity outcomes. According to the study, a green building is a structure that is resource-efficient, designed and built using ecological principles, and promotes health.

Oguntona et al. (2019) believed that a green building is a high-performing structure with negligible effects on the environment and human health. The report maintained that a green building is made to minimize not only its lifecycle environmental effects but also its water and energy usage. Improved human and environmental health, efficient use of natural and material resources, and efficient use of water and energy are some of the main attributes of green buildings. In addition to having better environmental performance, green buildings are designed, constructed, and maintained to increase occupant health and well-being,

productivity, and both (Oguntona et al. 2019). The advantages of green building are manifold and encompass the economic, environmental, and social dimensions of sustainability. Researchers found several advantages associated with green buildings and contended that, when considering the building life cycle, green buildings outperform conventional ones. Reducing energy and water consumption, lowering maintenance and operating costs, and improving productivity could all have a positive financial impact that is ten times greater than the additional construction costs needed to meet green design requirements. Moreover, it was asserted that implementing green building practices results in energy savings of about 30%. In addition, compared to conventional buildings, green buildings use 30 to 50% less energy and water, according to the report.

According to the study by Brian (2015), green buildings used 60% less energy and water than conventional buildings, which drastically lowers operating expenses. In addition, green buildings have a 10% higher market value and a 5%–10% higher rental rate. There were six code-compliant green buildings in the US that use between 25% and 75% less energy. Furthermore, a green manufacturing facility certified by the Leadership in Energy and Environmental Buildings (LEED) green rating system was found to increase employee productivity by 25% and reduce energy use by 30%. Like in developed countries, developing countries could benefit greatly from green buildings. The study concluded by saying that the best way to promote the development of green building in the construction industry is for the government to make more financing options available to key stakeholders of the construction industry.

Another study by Oguntona et al. (2019), revealed that the trend of green building is spreading throughout many nations, and additional regulations were predicted to accompany this growth. The need to lower the energy consumption of conventional buildings prompted Europe to be the first to develop regulations commissioning improvements to buildings' comfort and energy efficiency. Government rules and policies have been shown to be successful in advancing public awareness of green buildings. Tenants, among other stakeholders, were pushing for green buildings because of their advantages in terms of occupancy costs and environmental impact. According to the study, stakeholders could maximise the buildings' capital value by reducing expenses, raising revenue, and lowering

capitalization rates. The green building market is driven by the ability of green buildings to lower building operations and maintenance costs.

Green buildings, from residential to corporate, were becoming more and more popular due to our society's growing concern for the environment. Architects were developing new sustainable design techniques to protect our ecosystem while lowering carbon emissions. It's no secret that our environment had a big influence on our health and overall quality of life. Globally, architects have come a long way in the last few decades, creating sustainable architectural designs that have the potential to both significantly improve the lives of those who live in them and significantly lessen any negative environmental effects that they might have. Occupants living or working in green buildings reported a significant improvement in their general well-being, stress levels, and health thanks to interior design elements like better lighting, thermal conditions, ergonomic features, and even improved air quality (Adeniyi, Mohamed, & Rasak, 2020).

According to research by Jackson (2021), using water-efficient plumbing fixtures in green architecture could not only cut down on water waste but also ease the burden on shared water resources. Installing specifically designed systems to filter water makes it possible to recycle water and use alternate water sources, like rainfall. These advancements safeguard future supplies of clean water in addition to conserving this essential natural resource. Literally, residing in a sustainable building could save life. Studies showed that living in green buildings has many positive effects on one's health because of the environmentally friendly building materials used. For example, building materials that might release toxic fumes and carcinogens into the atmosphere, such as plastic by-product's or volatile organic compounds (VOCs), are not used in green buildings. These hazardous substances are associated with allergies, respiratory conditions, and other illnesses, as well as, in severe situations, a higher risk of cancer. The growing population of our planet, especially in major cities worldwide, is putting our local shared resources in jeopardy due to rising demand. Essential resources like water and energy are being preserved. Thanks to the innovations in sustainable practices and technologies created by creative architects around the globe. Green buildings can lessen the environmental effect on these resources by becoming more efficient, which may allow them to be saved and conserved for future generations. One of the main advantages of green

buildings is that they require less maintenance because they have specially designed features that minimise energy consumption and lower each occupant's energy and water bills, Liu et al (2022) added. Corporate and residential owners could save a tonne of money with these effective structures. Building owners might have to pay more up front to construct these kinds of buildings than they would for more conventional, non-green forms of architecture, but the cost is exponentially recovered in the long run, the study said.

Meus et al. (2021) were of the opinion that energy efficiency is a top priority for green architects when designing green buildings. It is very good for the environment to design structures that use energy from natural sources like the sun, wind, and water. This shields the ecosystem from pollution that comes from using non-renewable resources like coal and oil. An additional advantage is that, compared to energy-efficient alternatives (like solar energy versus conventional electricity), non-renewable energy sources are not only more expensive but also more harmful over the course of the infrastructure's lifetime. The number of big businesses choosing to participate in green initiatives had increased. The Environmental Protection Agency (EPA) estimates that thirty percent of greenhouse gas emissions in the US come from buildings. Large corporations and landlords had taken notice because boosting sustainability offers a chance to make a constructive contribution to both business and society at large. It's understandable that concerns about global warming have grown over the years given the dramatic depletion of our planet's natural resources and the unprecedented levels of pollution and climate change that resulted from them. In addition to being healthier and less energy-intensive for its occupants, sustainable architecture is good for the environment. Green architecture could actually maintain and improve a cleaner environment by lowering our reliance on non-renewable resources, or fossil fuels like coal and oil, the study revealed.

The use of recycled materials and resource recycling, including the conversion of existing buildings, had become popular in the architectural community. Green designers, engineers, and sustainable architects were utilising these resources to cut down on their carbon footprints and preserve natural resources (Alves et al. 2018). Green building companies are able to design extremely efficient structures that would stand the test of time by incorporating sustainable strategies like waste reduction, preservation of natural resources (like wood and water), protection of our air supply, and energy conservation into the design process. Going

green made sense for knowledgeable homeowners because sustainable materials have been shown time and time again to last longer, resulting in reduced energy and water usage, better air quality, and overall durability. Recycled decking and roofing are examples of green materials that not only withstand years of exposure to the weather but also require significantly less upkeep. Furthermore, they are better for the environment and the people they serve because a large number of them are devoid of dangerous chemical treatments. The phrase "urban greening," which is defined as an integrated approach to the planting, care and management of all vegetation in cities, towns, townships, informal settlements and urban areas, is most closely linked to the term "greening." Urban forestry, agro forestry, and urban agriculture/perm culture are all included. Urban greening is being spearheaded by the Department of Human Settlements, whose National Greening Strategy aims to direct local governments in creating their own urban greening plans and policies. The plan shows how environmentally proactive interventions lead to sustainable livelihoods, and how environmental management and sustainable livelihoods are interconnected. The report added that the National Greening Strategy takes a comprehensive approach to urban greening, with three main goals in mind: protecting the environment, making urban areas more aesthetically pleasing, and helping impoverished communities by promoting the creation of food gardens in these areas. Enhancing the quality of all urban open spaces was another goal of applying urban greening. Urban greening thus encompassed areas other than parks and the side of the road, such as home gardens, factories, and commercial districts. The strategy calls for applying greening to parks and open spaces; street trees, which suggested planting a tree for each home in low-income neighbourhoods; community food gardens; townships and informal settlements; and private spaces where planting fruit trees and small-scale food gardens with recycled grey water was encouraged.

Bamigboye et al. (2019) discovered that in the world of commercial construction, sustainability has gained popularity, and not just because builders, engineers, and architects were suddenly acting more ethically. A minimum percentage of recycled materials must be included in the building materials used in many publicly funded projects for the past 20 years. Growing consumer concern for the environment and public sector requirements has increased demand for more sustainable building materials.

Greener buildings were found to be becoming more and more popular in both residential and commercial construction, and it all starts with the right materials. The energy efficiency of the building and the long-term wellbeing of its occupants are greatly impacted by the selection of the best sustainable building products and materials during the design phase. By 2023, it's anticipated that the US market for sustainable building materials will grow to over $100 billion. Additionally, the market for sustainable building materials is anticipated to expand even further as more governments impose energy-efficiency and carbon-neutrality requirements. Building green is becoming the new norm for both commercial and residential contractors; it is no longer just a fad. Products or materials made from recycled or renewable resources are referred to as "green building materials." When considering the production, transportation, and installation phases of their life cycle, green building materials have the least negative effects on the environment. Common examples include recycled or sustainably sourced steel, stone, ferrock, bamboo, and reclaimed wood (Collins et al. (2003).

Processes and materials were harmoniously integrated in green construction to increase sustainability. The National Institute of Building Sciences created the Whole Building Design Guide, which lists six essential, ageless principles of sustainable building design, to assist industry professionals in achieving more standardised processes: Maximise site potential, which involved repurposing already constructed structures or a previously developed area. Prioritising should be given to minimising or controlling storm-water runoff, improving local ecosystem health, and ensuring physical security, make the most use of energy, especially renewable energy sources. The objective is to construct and manage net-zero energy structures that can drastically lessen reliance on fossil fuels. Protect and Conserve Water by using water wisely, recycling or reusing it when it could, and reducing the financial and environmental costs associated with sewage treatment. Make the most of the building's space and use, taking into account resource conservation and the structure's adaptability for future uses over its lifetime. It is imperative to improve the health and safety of employees and tenants. Optimise Indoor Environmental Quality (IEQ), which includes minimising the use of potentially hazardous materials emissions, optimising acoustic performance, maximising daylight, and controlling ventilation and moisture appropriately and optimise the methods for operations and maintenance, such as early planning for the most effective upkeep of a structure. Highly qualified individuals should be involved in the design and development stages of building operations and maintenance (Frigione and Aguiar (2020; Larsson, Jansson, and Boholm 2019).

Building sustainably benefited both builders and their clients according to Brian (2015). Visible features like repurposed furniture or naturally occurring surfaces like wood cladding are examples of these advantages. Benefits also included things like steel-stud-framed walls, low-VOC paint, and reversible flooring that aren't immediately apparent. Reducing carbon footprints was another advantage of building sustainably. Based on estimates, the built environment accounts for almost half of the world's greenhouse gas emissions. Over 20% of those emissions were coming from the building process. For landowners, developers, designers, architects, and final consumers, a building with a lower carbon footprint could be a major selling point, the report discloses.

According to Meena et al. (2022), the benefits of using sustainable building materials extend beyond the space's interior design. There were several significant benefits to sustainable construction for all parties involved:

● through the reuse or repurposing of existing materials in new projects, sustainable construction reduces waste. By better managing water resources, it could also cut down on resource waste. Water usage could be significantly decreased by utilising dust suppression techniques, closed-loop water recycling, or energy-efficient water hoses. Water conservation and recycled water systems would also reduce construction costs. Reusing resources also improves efficiency in the procurement of materials, one of the major obstacles in commercial construction. When raw materials are used more efficiently, fewer materials are needed for each building project, which streamlines logistics and cost reports.

● Using sustainable building practices could save a lot of money. Even though some materials may initially cost more, overall project costs ciuld drop significantly when fewer materials, energy, and water are used in the process. When implemented consistently and supported by an appropriate strategy, a sustainable building approach could have a positive effect on the financial performance of any construction company. Innovation and sustainability complement each other well, and the construction sector is no exception. New technology-infused materials could outperform their conventional counterparts in terms of durability, quality, and environmentally friendly sourcing. A genuine, long-term focus on sustainable building must be innovative in nature. This entails selecting building materials that are more economical and sustainable while still fulfilling the requirements of a project.

● Sustainable construction could revolutionise the economies of the places where they are built to offer a global solution. It is currently anticipated by experts that most commercial construction projects over the next three years would adhere to green principles. The U.S. Green Building Council states that this change is starting to have a major positive economic impact. In addition to reducing energy expenses, green building enhances occupants' comfort, health, and quality of life. Research has demonstrated how green buildings can lessen the symptoms of allergies, asthma, and other conditions. According to Abdulrahman et al. (2020), using eco-friendly building materials could have positive health effects. Outdoor air is two to five times less polluted than indoor air, according to the Environmental Protection Agency. There may be health risks associated with synthetic materials used in construction and furniture. Consequently, environmentally friendly building materials used inside the health resort, such as wood, stone, ganache board, glass, mud, pebbles, aluminium, and seagrass or seaweed, could aid in air purification. (Ekhaese and Ndimako 2023),

According to Jackson (2021), the construction sector is by definition one of the biggest users of minerals and other natural resources. The growing concerns about global warming and the finite nature of resources have brought sustainability in construction to the forefront of discussion. There was more pressure on construction companies to lessen their environmental impact as a result of this conventional truth. Because the construction industry could drastically lessen the effects of global warming by implementing modern practices, it is then unique. Sustainable and green building techniques are becoming increasingly important, as many construction companies are realising. New developments in technology, materials, and practices have been made during the past ten years to enable and promote overall efficiency in response to the growing interest in sustainability and energy conservation. Using sustainable materials is one of the best ways to incorporate sustainability into construction. A new generation of stronger, lighter, and renewable building materials, like insulated access doors and panels, have been made possible by technological advancements. These materials have the potential to encourage the adoption of more environmentally friendly traditional practices. Because these environmentally friendly materials lessen the carbon footprint of the buildings that use them, they also contribute to a cleaner Earth. They are far more efficient and aesthetically pleasing than their non-renewable counterparts, while serving the same purpose, Ezeokoli et al. (2023) stated.

In order to achieve the global carbon reduction targets, a "rapid and far-reaching" sustainable transition in land, energy, buildings, transportation, and cities is required. Buildings would be crucial to a sustainable transformation, contributing nearly 40% of the CO2 associated with energy worldwide. Green buildings, such as those with LEED certification, offer cities, communities, and neighbourhoods a global solution. Tenants and guests might not immediately see the obvious advantages, but green buildings are lowering our exposure to toxins, conserving water, reducing carbon emissions, energy, and waste, and prioritising safer materials through sustainable design, construction, and operations (Ayarkwa et al. 2022). Healthier buildings and customer demands are the two main drivers of green building in the United States, but the financial advantages are also significant. It has been regularly reported that new green buildings and green retrofits have lower operating costs, shorter payback periods, and higher asset values. Properties become more valuable when green building is invested in up front; many building owners report an asset value increase of at least 10%. Since 2012, the proportion of owners reported that level of growth has almost doubled, the report indicated.

Green buildings had many advantages over non-green buildings, according to a number of studies (Park et al., 2014; Castleton et al., 2010; Thatcher & Milner, 2014; Wiley et al., 2010; Ashuri & Durmus-Pedini, 2010). Green buildings maximised occupant productivity and well-being, reduce greenhouse gas emissions, generate less waste, and guarantee greater satisfaction and a lower absenteeism rate. Promoting well-being, typically in relation to the environment, health, and community, is the main goal of green building, according to Ashuri and Durmus-Pedini (2010). Furthermore, there were observable financial advantages like lower energy and water consumption. Other advantages of green building included those related to the market and industry (Ashuri & Durmus-Pedini, 2010). However, Kim et al. (2017) asserted that these advantages are expensive. A study by Chegut et al. (2014) that looked at the value, supply, and demand of green buildings was considered empirical evidence. Tenants in green office buildings paid about 20% more in rental premiums than tenants in non-green buildings, according to the study (Chegut et al., 2014). Therefore, increasing the amount of trustworthy information and knowledge about the advantages of green building would help to dispel misconceptions and better inform stakeholders and the general public about sustainability (Darko et al., 2013). Khoshbakht, Gou, and Dupre (2017) stated that gathering a variety of cost-benefit variables is essential for a comprehensive set of

economic assessments and that this information ought to be shared with different green building industry stakeholders.

According to Ashuri and Durmus-Pedini (2010), most categories of benefits had secondary financial benefits in addition to their primary classification as environmental, health and community, financial and economic, market, and industry. The environmental benefits of green buildings were widely acknowledged, according to Shabrin & Kashem, 2017; Darko et al., 2013; Nurick & Cattell, 2013). The environmental advantages of green building, according to Darko et al. (2013), included enhanced air and water quality, decreased waste, preservation and restoration of natural resources, and safeguarded biodiversity and ecosystems. Similarly, a US Environmental Protection Agency report found that green buildings reduce waste streams to the air and land, preserve and restore natural and renewable resources, improve air and water quality, and enhance and protecte ecosystems (USEPA, 2009). Shabrin and Kashem's (2017) research also showed that reducing heat gain is a green building's environmental benefit, especially when a building is oriented and designed to maximise day lighting.

According to Shabrin and Kashem (2017), there were several financial advantages to green buildings. There were both direct and indirect benefits. Green buildings have shorter payback periods because they use less energy, water, and have lower health care costs. This means that there is a quicker return on investment and more revenue. The second benefit is a decrease in operating costs due to the fact that green buildings use less energy and water and require less upkeep. Green buildings are more valuable than non-green ones because their owners and developers could charge higher rents and have higher occupancy rates. However, because green buildings are unique products that are both environmentally and technologically cutting edge as well as socially responsible, they also have the indirect benefits of improved internal building conditions, which boost occupant productivity through good indoor air quality and thermal comfort in the workplace, branding and prestige.

According to Darko et al. (2013), there were several financial advantages associated with green building, such as lower operating costs, the development, growth, and forming of green product and service markets, increased occupant productivity, and optimised financial performance over the building's lifetime. Based on Srinivas' 2009 research, green buildings

had the potential to dramatically lower energy consumption by 20% to 40% and potable water consumption by 30% to 40%. Also, Darko et al. (2013) indicated that some of the social benefits of green building include improved occupant comfort and health and aesthetic appeal.

Khoshbakht et al. (2017) stated that benefits of green building included varying cost savings and financial gains both during and after building construction, such as increased property market value, increased rents, fewer vacancies, marketing opportunities brought about by social benefits, lower carbon taxes, increased energy savings, fewer sick leave days, and increased productivity. According to Shabrin and Kashem's (2017) theory, green building's social and community components gave residents more chances to create jobs. For instance, a large number of jobs would be available because green building is a relatively new business and younger generations could conduct research and explore this field.

Ashuri and Durmus-Pedini (2010) asserted that green buildings had a tendency to create jobs. As a result, as the number of employees occupying green buildings rises, their increased job satisfaction would lead to a demand from colleagues in the industry for environments that are similar. However, this would enhance the financial, environmental, and health benefits by creating a positive feedback loop in the market (Ashuri & Durmus-Pedini, 2010). In terms of market aspects, the advantages included generating value within a compatible market, increasing occupancy rates, decreasing vacancy times, satisfying tenants' increasing demands, brand recognition for the business, and reduced advertising expenses (Ashuri & Durmus-Pedini, 2010). Furthermore, Ashuri and Durmus-Pedini (2010) believed that the benefits of green building to the industry also included boosting the building sector's performance, allowing technology to be incorporated into the process, enhancing project outcomes, professionals becoming more qualified, educated, and integrated, opening doors for other nations and selling green building know-how, generating new opportunities for other industries outside of the construction sector, helping to create and increase job opportunity.
However, it is noteworthy that there existed additional advantages of green building beyond the aforementioned benefits. These advantages included chances for green building research and development, increased tax income for the government, and advantages connected to climate change (USEPA, 2014). Shabrin and Kashem (2017) asserted that when it comes to

research and development, scientists would always figure out how to improve the building. Additionally, because the greenhouse effect would eventually harm the environment, researchers should concentrate on it. In terms of the government, the employment opportunities provided by the green building would result in a greater workforce in a specific location. Tax revenue from corporations and employees could be increased for the government (Shabrin & Kashem, 2017). In terms of benefits related to climate change, vegetation found in green infrastructure helped reduce atmospheric CO2 levels through direct carbon sequestration, lower water and wastewater pumping and treatment costs. Compared to conventional commercial buildings, LEED buildings have been found to have maintenance costs that are nearly 20% lower, and green building retrofits usually result in an almost 10% reduction in operating costs in just a single year. Every community and every market should have green buildings.

Based on USGBC research, clean air and water as well as reduced exposure to toxins were the green building benefits that most resonated with them. Learn from communities that place a high priority on health in all areas, including buildings. Public health is positively impacted by green buildings. Reducing absenteeism and work hours caused by respiratory allergies, depression, stress, and asthma could be achieved by improving indoor air quality. Green buildings encouraged the use of designs, materials, technologies, and procedures that increase resilience. Green buildings supported these efforts by encouraging the use of long-lasting materials, careful site selection, demand response, grid islanding, rainwater collection, energy efficiency, on-site renewable generation. Resilience could also be beneficially applied to both small- and large-scale projects. Aiming for resilience at the community or portfolio level could promote better communication between tenants and landlords. With resilience planning, people could live better, the report stated.

Green buildings contributed to waste, energy, water, and carbon reduction. The Department of Energy discovered that the buildings reduced their CO2 emissions by 34%, used 25% less energy and 11% less water, and avoided sending more than 80 million tonnes of waste to landfills. In addition to strongly electrifying the building sector and reducing energy demand, the IPCC report advocated switching to high-performance appliances, water heaters, lighting, and appliances. Green buildings facilitated this transition and enabled performance verification for product manufacturers, architects, developers, and building owners and

managers. Green buildings contributed to the reduction of indoor air pollutants linked to major health problems by increasing energy efficiency. According to Zender – Świercz, (2020), improvements in health, well-being, and quality of life were linked to the social benefits of sustainable design. These advantages could be experienced on several levels, including those of the community, buildings, and society at large. Three main areas of focus have emerged in building-level research on the human benefits of sustainable design: satisfaction, comfort, and health. Despite the obvious connections between these results, their methods and scholarly origins were different. Public health professionals and epidemiologists handled health-related issues. Researchers with backgrounds in physiology and building science study comfort, whereas experimental and environmental psychologists focus on psychosocial processes and well-being. The studies discussed in this section combined research from these various fields, with an emphasis on studies that evaluated the effects of having or not having sustainable building elements on outcomes related to comfort, health, and well-being. The quality of life of building occupants could be affected by the building environment in both positive and negative ways (Zender – Świercz, 2020).

The main social benefits of sustainable building practices that had been studied were their effects on occupants. Other societal groups might also experience a variety of secondary and indirect quality-of-life benefits for which there is anecdotal evidence. Individual life expectancy and state of wellness were two metrics that could be used to quantify quality of life from the standpoint of public health. More broadly, community quality of life could encompass things like the state of the environment, aesthetics, recreational and educational opportunities, accessibility, the calibre of public services, and even psychological traits like pride and community satisfaction. The adverse effects of poor indoor air quality, thermal conditioning, lighting, and certain interior space design elements (e.g., material selections, furnishings, and personnel densities) include sickness, absenteeism, weariness, discomfort, stress, and distractions. Reducing these issues through sustainable design frequently would enhance performance and well-being. Strongly beneficial effects include enhanced personal control over temperature and ventilation, as well as better indoor air quality. Buildings should have characteristics that not only lower risks and discomforts but also foster positive social and psychological experiences (Ekhaese and Ndimako 2023).

Eco-friendly construction, according to nationwideconstruction.com (2016), entailed using resources wisely and environmentally conscious materials and methods for the whole building life cycle. Green buildings, once written off as expensive, are becoming more and more popular due to their numerous benefits over non-green construction, which include social, economic, and environmental benefits. Green buildings were constructed with special elements that guarantee the economical use of resources like energy and water. Green buildings, for instance, significantly reduced the amount of power used in lighting systems by utilising task lighting strategies and lots of natural light. This enabled users to save up to a third on their water and energy bills. Reducing these expenses would greatly boost the profits of building owners who got rent from their properties, since operating and maintenance costs could make up as much as 80% of a building's lifetime costs. Green buildings are much less expensive to build in the long run than their non-green counterparts because of lower operating and maintenance costs. This is true even though the initial cost of construction might be slightly higher. Green building designers made every effort to lessen reliance on energy derived from non-renewable sources, like coal. In order to do this, they installed solar panels to harness the energy of the sun and create windows that let in as much natural light as possible while using less artificial light; these, along with other measures, guaranteed that the building uses energy effectively. Because non-renewable energy sources are costly and harmful to the environment, energy efficiency is crucial for everyone on the planet, not just the user. The conditions inside a building and how they impact its occupants determine the quality of the indoor environment. Air quality, lighting, ergonomics, and temperature are some of these conditions. A high-quality indoor environment protects the health of building occupants, reduces stress, and improves their quality of life. This is accomplished by installing movable windows that allow as much natural light as possible and utilizing less materials that may emit toxic compounds into the air (Simpeh and Smallwood, 2021).

Utilising water resources in a way that conserved water and guarantees a steady supply of clean water for present and future generations is known as water efficiency. Using rainwater and other alternative water sources is made possible by green building. Water waste is also minimised by installing efficient plumbing fixtures and installing systems that enable recycling and purify water, all of which lessen the demand on shared water resources. The safety of the materials used in the construction of green buildings confers numerous health benefits on their occupants. Eco-friendly construction firms, for example, steer clear of

plastic by-products, which have been shown to release hazardous substances. In addition to causing severe respiratory problems, carcinogens and other toxic substances raise the risk of developing cancer. Material efficiency was using physical processes and materials in a way that minimises material use without sacrificing the quality of the result; the processes should also produce the least amount of waste possible. Green building companies used durable materials, recycle and reuse some products, design buildings to use fewer materials, and use less water, raw materials, and energy in their processes to achieve material efficiency. Each of these contributed to material efficiency. Green buildings helped maintain a clean environment by using less energy from sources that pollute the air, like coal. Additionally, they contributed to slowing down the rate of climate change by lowering the amounts of carbon dioxide released into the atmosphere. As the population rises, local shared resources such as energy and water face significant demand. Green buildings could lessen this strain by utilising water and energy-efficient technologies and procedures (Seppanen, Fisk, and Mendell, 2016).

Ekins & Zenghelis (2021) were of the opinion that climate risks intensify all environmental concerns. It was observed that greenhouse gas stocks, not yearly emissions, are what drived global warming. Because this is the only way to stabilise the stock and stop the temperature from rising, maintaining the global temperature at any level necessitates the shift to a world with net zero emissions. This implies that the planets would either naturally stabilise its temperature through depopulation and industrialization, or humankind would manage the transition.

Many of the practices, institutions, and technological networks of the previous century appeared destined to become obsolete or become stranded if humanity decides to rapidly reduce its carbon footprint in accordance with the Paris Agreement's target. Particularly in cases where they lack adaptable and responsive institutions, economies that rely heavily on fossil fuels for both production and trade might find it more difficult to transition than others. This was a problem not only for certain gulf states, but also for more diversified but still "carbon entangled" nations like Russia, Nigeria, Kazakhstan, Indonesia, or Poland. In other instances, such as with coal in India or oil in Venezuela, organisations based on fossil fuels contribute significantly to the official or unofficial welfare state of a country or region. Approximately one-third of the world's population lived in such fossil fuel-dependent nations

(Peszko et al. 2020). Many faced urgent challenges of poverty, conflict, and violence; they also had weak and rigid institutions and restricted access to international finance, Ekins & Zenghelis (2021) revealed.

After acknowledging the necessity of a low-carbon transition, it is important to be clear that there would be winners and losers in any significant change, with the losers experiencing disruption. It could also see from a cursory glance at the global political economy that these issues required careful handling due to the possibility of delay, retaliation, resistance, and resource waste. In fact, they coulg make it difficult for any economy to react to the forces of structural and technological change. In order to manage change and make it possible for everyone to benefit from better economic and social conditions, it is therefore essential to understand political economy. These worries, though, shouldn't be mistakenly confused with financial worries about the actual potential of environmental laws, should they be put into place. Legislators must restrict the alleged justifications for obstructing or delaying essential change (Ojo-Fafore, Aigbavboa and Remaru, 2018).

Maintaining social cohesion, economic justice, and the ability for the climate transition to occur would depend on ensuring a just transition. Enabling institutions that retrain, retool, and compensate impacted workers are necessary for this. Along with policy support for those living in towns and outlying areas that are better suited to handle change, it also called for policy responses to make up for consumers who bear disproportionately higher costs (for instance, through brief increases in energy or transport bills). According to Zenghelis et al. (2018), economies that were adaptable, have diversified assets, and have flexible institutions are more adept at handling structural adjustment. This is supported by economic theory and historical evidence. Resources from ageing, low-productivity sectors could still flow to new, more productive sectors without being hindered by such economies. To obtain a competitive edge, they promote, oversee, and direct it (Combes and Zenghelis 2014). Building on this historical evidence, this section made the case that quick innovation in institutions, behaviours, and technologies is required to address resource and environmental challenges. Many immediate co-benefits of a transition were emphasised in the report. These are essential for encouraging early voluntary action on decarbonisation and resource efficiency based on short-term self-interest, along with incentives from new policy drivers. For instance, large, crowded, dirty cities with outdated energy technologies and ineffective infrastructure generally failed to draw in highly skilled workers and hinder GDP growth and general well-

being. This refuted the myth that moving towards a carbon-neutral economy would inevitably result in situation getting worse before getting better. Additionally, it stalled the innovation and investment required to enable an affordable transition. Businesses and governments that were caught off guard ran the risk of being left with obsolete, uncompetitive production methods and stranded assets when change finally occurs. The degree to which it could separate resource use and environmental degradation from growth and consumption depends on innovation. Bosetti et al. (2006) and Popp (2004) were two examples of models that have tried to include innovation in the context of climate economics. But these models typically ignored crucial interactions, spill-overs, and processes at the firm and sector levels, as well as the importance of mission-driven.

Not everything that is innovative "happens." As stated by Aghion et al. (2014), it all depends on three different types of path dependencies: (1) research and development; (2) deployment and uptake; and (3) network effects and economies of scale. Moving the innovation system from dirty to clean technologies without direct policy intervention is initially challenging due to strong inertia and high switching costs. However these effects reverse when they reach a tipping point where technologies shift from one network to another and expectations change quickly (Krugman 1991; Matsuyama 1991). Decreased technology costs provide positive and reinforcing feedback loops that speed up additional technology deployment and investment in supporting networks, infrastructure, and institutions. In fact, it's the high switching costs and potent network effects that caused this. By creating network externalities, enabling infrastructure investments lead to technological tipping points. For instance, the incentive to carry out research and development on electric cars rised in comparison to combustion engine (or fuel cell) vehicles, as the infrastructure for electric vehicles is implemented.

Network analysis was used by Hidalgo et al. (2007) and Mealy and Teytelboym (2017) to show that it is simpler for nations to become competitive in new green products that demand production capacities and know-how comparable to those of established sectors. Green transitions are therefore very path-dependent; nations that effectively invest in green capabilities at an early stage are more likely to successfully diversify into green product markets in the future. This supported the findings of Aghion et al. (2012), who presented empirical evidence showing that firms typically focused innovation on what they were

already good at, and that the practices of the nations where their researchers and inventors are located have an impact on a firm's decision to innovate cleanly or dirtily, the report revealed.

According to Ostrom (2000), social norms are the dominant behaviours in a society that were upheld by a common understanding of what constitutes appropriate behaviour and maintained through social interactions. Social feedback contributed to the self-reinforcing and hence stabled nature of norms. Without public support, formal institutions found it difficult to impose outcomes that are generally desired. Legislative change is ultimately driven by social norms and acceptable standards of behaviour, which served as the foundation for law (Posner 1997).

The process of changing norms could be aided by laws, levies, subsidies, or infrastructure improvements like bike lanes, dense housing, and public transportation. Bicycle sales would increase if cycle lanes were built. Giving people reasons to alter their expectations and behaviours is one of policy's potentially powerful roles (Young 2015). Social psychologists had long recognised that creating "common knowledge" and incorporating expectations into models are necessary to address coordination issues (Thomas et al. 2014). This could manifest itself in low- and middle-income nations as political procedures that grant public institutions the power and capability to create agglomeration hubs in addition to disseminating novel innovations (Collier 2017).

Through multi-national inward investment, trade, and foreign finance, this could aid in putting in place the infrastructure, skills, and legal and fiscal frameworks necessary to draw in knowledge from around the world. According to Easterly and Levine (2003), institutional development is essential for facilitating technological innovation, uptake, and expansion. Additionally, it made it possible for universities, research facilities, and high-value urban employment to spread home-grown innovation. Rather than being a barrier, decarbonisation might give low-income nations a chance to spur economic growth by creating new opportunities instead of depending on gradually altering their outdated infrastructure, which they lack. Local technology clusters reduce information, transaction, and installation costs and have a positive knock-on effect in all countries, regardless of income levels (Porter 2000).

A study by Rogers (2010) demonstrated how social networks and the proximity of homes explained why homeowners installed solar panels in clusters. By exerting pressure on lawmakers and influencing strategic decision-making contexts, like those in the financial sector, shifting social norms could also increase the costs associated with pollution. When investors started to see risk in previously considered safe high-carbon resource-intensive sectors, investment norms also changed. This is because investors might become concerned that assets, such as resources, physical infrastructure, human capital, and intangible know-how, might become worthless or stranded in the next decades. In the meantime, the risk premium associated with investing in clean sectors—which were once thought to be exotic—drops as a result of their perceived increased resilience to a future with low carbon resources (Bradshaw 2015; Zenghelis 2016). As a result, insurance providers and pension funds started decreasing their backing for coal-related projects (Financial Times 2018). Pollution externalities were not only unprized, but policies still actively promote actions that harm the environment. According to IEA estimates, subsidies for fossil fuels were twice as large in 2015 as subsidies for renewable energy sources (Van Asselt and Kulovesi 2017). Doing away with fossil fuel subsidies would have resulted in a 21% decrease in global carbon emissions in 2013, an increase in net public revenues of 4%, and a decrease in mortality, according to Coady et al. (2015),

Machaka and Windapo (2018) found that, despite the growing demand for affordable, environmentally friendly structures for residential and commercial uses, stakeholders generally agreed that the cost of structures obtained through sustainable construction programmes is much higher than the cost of structures built using traditional building methods. Although both conventional and sustainable building types had cost advantages, construction stakeholders thought there was less of a cost difference between them. This disproved earlier theories that suggested the costs of the two types of buildings were very different. Because of the ecological benefits of sustainable building, the government should support the development of these structures through incentives and legislation, even with the slight cost difference between the two buildings (Machaka and Windapo 2018). According to the study, innovative building practices, sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor building environments, and construction methods were all combined to create sustainable construction. Utilising sustainable building techniques, which covered waste disposal, demolition, and raw material extraction, all of the green building tenets are put into practice, the study indicated.

According to Du Plessis et al. (2002), conventional methods are a strategy to draw attention to the issues of poverty and underdevelopment by utilising more environmental resources. Ali (2009) believed that going green might save an investor money on maintenance, but it might take years for their investment to pay for itself. Because green building practices were thought to be more expensive and might have negative financial effects, investors frequently have doubts about them (UNEP, 2009). According to Kruse's analysis from 2004, because conventional construction methods had negative effects on the environment, including climate change, there was a call for the construction industry to switch to green building practices. The industry's continued adoption of traditional building techniques, such as heavy lifting and on-site crane use, contribute to environmental degradation and major climatic shifts like global warming that result in torrential rain and flooding.

It's probable that stakeholders' opinions of the high costs of green buildings and the absence of working documents requiring the use of green building techniques contributed to South Africa's ongoing use of conventional building methods. Research by Windapo and Goulding (2015) and Umar and Kamidi (2012) demonstrated that the majority of stakeholders lacked knowledge about sustainable construction practices and initiatives, as well as where these practices belong in these domains. According to Webb's (2005) research, many experts in green building considered materials to be more significant than air quality and water efficiency and view green building practices as an energy-saving strategy. Umar and Kamidi (2012), Copiello and Bonifaci (2015), and Stephan and Stephan (2016) had also emphasised this point, finding that people's perceptions of green buildings are primarily based on energy efficiency. According to Jay et al. (2013), there is a connection between the awareness issue and a lack of understanding about sustainability.

Matthiessen and Morris (2004) stated that the advantages that investors and tenants enjoy once the project is finished outweigh the small cost difference between the two construction methods. They went on to say that the sustainability and design of the building would determine how much the difference in cost would be. Suttel (2006) concurs, stating that as long as the original design is completed, green buildings could be built for little to no additional cost. The author maintained that a lack of information about the relative costs of conventional versus green buildings and vice versa had led to the public's belief that green buildings are more expensive than conventional ones and the continuous use of conventional construction techniques.

Sustainable construction, according to Shiniwa (2008), includes both external and interior energy-efficient building components, such as the installation of green roofing, as well as the use of green buildings. This is the procedure for creating a plantation-style roof on a building by planting materials like grass and trees on the roof. According to the GBCSA (2013), there are a number of advantages to green buildings with green roofing, one of which is a decrease in ambient temperature due to the cooling effect of the plants' evaporation. Furthermore, the interior of the roof is kept cooler by the shading that the green roofs provide (Shi and Wei, 2011). Furthermore, the thermal comfort that green roofs offer is advantageous to those who live directly below one on the upper floor (GBCSA, 2013). Then, the people living under the green roof realised that the temperature was pleasantly moderate throughout the entire year. The main reason for the naturally cooler floor beneath the green roof in the summer is the evaporation and retention of water from the soil (Shoniwa, 2008).

Sustainable construction is the process of improving environmental factors and combining them with social and economic considerations. To attain a well-balanced work environment, work competence, and life quality, those components must be integrated. Furthermore, minimizing the quantity of energy, waste, and materials used in the building and maintenance of buildings is a key component of sustainable building practices. The study emphasised that social welfare, environmental preservation, and economic prosperity were the three main pillars of sustainable construction. But in some studies, the three components were simply identified as "economic, social, and environmental practices." Economic practice focuses on the financial impacts that an organization's activities have on the community and its stakeholders. The project's financial gains for the general public, the government, the building sector, and the clients are the main subject of the economic influences (Oguntona et al. 2019). Social equity and justice aim to promote social stability and alleviate poverty by ensuring that everyone has access to fundamental necessities like clean water, healthcare, and education. It also encourages cultural diversity and the preservation of cultural history, which helps to build better, more resilient communities. Environmental sustainability guarantees that countries have a positive environmental impact by promoting sustainable practices such as recycling, trash reduction, and the use of renewable energy sources. Environmental sustainability also advocates the conservation and protection of natural resources like forests, oceans, and wildlife habitats, which are critical to the planet's health and well-being, the study discovered.

Risk management, quality assurance, and supply chain management are examples of economic practices. Every phase of the building process, from design to procurement, construction, and finishing, required the application of quality control. According to supply chain management, criteria that incorporated sustainability principles should be used in the evaluation and selection of suppliers. Using such economical techniques would be crucial to achieving sustainability in the building industry. Social practice refers to an organization's continuing obligation to respect moral principles, improve the working environment, and advance society. It involved the contributions of humans—abilities, health, knowledge, and motivation—as well as their emotions—security, contentment, safety, and comfort. Other social practices include social responsibility and participation from construction companies. The report also emphasised how construction companies could show their social commitment to sustainable building by enhancing worker education and training and enhancing health and safety management. Laws, regulations, and legal frameworks pertaining to sustainable building must also be followed by organisations. Waste management, energy efficiency, environmental involvement, and regulatory compliance with environmental issues are the characteristics of construction companies' environmental practices. They also include pollution reduction, green procurement, and environmental training programmes. Implementing environmental practices such as waste management and energy efficiency could lead to fewer environmentally hazardous processes, more qualified personnel, and improved waste management during project execution (Simpeh and Smallwood, 2018).

According to Dosumu & Aigbavboa (2021), there are more benefits than drawbacks to adopting sustainable building practices. Nevertheless, the primary benefits of its adoption are not global in scope, mainly because they are regional and national in nature. Several studies have looked at the benefits of sustainable building for local economies. From an environmental perspective, the main benefit of sustainable building is the preservation of ecosystems. This is easily guaranteed by incorporating landscaping features or by employing qualified ecologists to evaluate the specific needs of region, initiates suitable management procedures, stop actions that result in habitat loss, and utilise species that belong in landscaped areas (Ametepey et al., 2015: 1687).

Reductions in carbon emissions that prevented severe climate change and global warming were among the environmental advantages of sustainable construction that were also highlighted (Vazquez, Rola, Martins, Freitas & Rosa, 2011: 271; Simpeh & Smallwood,

2018: 1845). Sustainable construction has the environmental advantage of conserving water through water supply, water consumption, and wastewater systems in addition to minimising waste through recycling, reusing, and cutting waste streams (Ametepey et al., 2015: 1688). Out of the 19 environmental benefits that Waidyasekara and Fernando (2012: 10) in Sri Lanka looked at, it was discovered that the top four were better indoor air quality, reduced energy use, reduced use of fossil fuels, and the preservation of ecological resources. Reduced resource usage was the least advantageous outcome.

According to Simpeh and Smallwood (2018), improved air and water quality, reduced waste, conservation, and restoration of natural resources are ways to protect biodiversity, as well as reduce heat gain, particularly in situations where buildings are oriented and constructed to maximise day lighting. Dosumu and Aigbavboa (2018: 1455) enumerated the following benefits of sustainable construction for the environment: reduced energy consumption, reduced air pollution, reduced solid waste generation because space is created for recyclable waste materials to be stored and collected, waste management practices on construction sites, modular construction techniques, reduced lighting disturbances, reduced water use, and reduced use of fossil and nuclear fuels. According to Wadyasekara and Fernando (2012), some of the environmental advantages of sustainable construction include: less use of potable water; better indoor air quality; reduced energy use; less use of fossil fuels; protection of ecological resources; lower pollution discharges to waterways; reduced air pollution; conservation of soil and water; reduced carbon dioxide emissions; increased local recycling market; preservation of land; and less impact of fossil fuel production and distribution.

Simpeh and Smallwood (2015: 1845) defined financial benefits as an alternative phrase for the financial advantages of sustainable construction. But they also expressed concern about the ignorance of the South African construction sector regarding the full benefits of sustainable building practices. Simpeh and Smallwood (2018: 1845) uncovered that sustainable construction offers various financial benefits, such as reduced operating expenses, enhanced market share, elevated occupant productivity, and optimised financial outcomes throughout a building's lifespan. It is also possible to view the immediate advantages of energy and water use as economic (Oluwunmi, Oladayo, Role & Afolabi, 2019: 9).

According to Liu, Pypłacz, Ermakova, and Konev (2020: 6), incorporating green design principles into a building construction is essential to its economic advantages. In comparison

to retrofitting conventionally designed buildings with green technologies, this could yield additional cost savings of 40% and performance improvements of 40%. Reduced energy costs, fewer health problems among workers, and increased productivity are further benefits of sustainable construction. Lower energy costs, lower annual electricity costs, lower annual water and wastewater costs, and lower annual fuel costs were listed by Waidyasekara and Fernando (2012: 9) as the economic benefits.

The social benefits of sustainable construction have not received as much attention in the literature as the other benefits, which made it very challenging to categorise each benefit. It was observed that a construction project's sustainability depends just as much on its construction method as it does on its positive effects on the environment, the economy, and society (Vazquez et al., 2011: 272). Simpeh and Smallwood (2018: 1847) highlighted that sustainable construction offers several social benefits, such as enhanced comfort, job creation, occupant health, and aesthetic appeal. The market for greener products grew as a result of protecting water supplies; there were also less detrimental health effects, more options for employee transportation, and improved occupant comfort and satisfaction (Waidyasekara & Fernando, 2012: 12).

Un-categorizable benefits of sustainable construction include opportunities for job creation in the building industry, more tax revenue for the government, benefits regarding climate change, reduced carbon emissions, a reduction in the need to pump water and wastewater, and a reduction in energy consumption. Lessening the impact on nearby infrastructure, preserving ecosystems and biodiversity, enhancing indoor air and water quality, lowering pollution and environmental degradation, setting a standard for future building, promoting the exchange of best practices, cutting operational costs, raising occupant productivity, and lowering utility costs are some additional advantages (Oluwunmi et al., 2019: 11). According to Sinha, Gupta, and Kutnar (2014: 48), some benefits of sustainable construction include cost-effectiveness, environmental friendliness, reliance on natural resources, durability, healthy living conditions for occupants, preservation of livestock, resource management, decreased reliance, pollution control, and improved growth and yield. According to USGBC estimates, green buildings in North America saved 30% on energy use, 35% on carbon emissions, 30% to 50% on water use, and 50% to 90% on waste savings. The Commission for Environmental Cooperation released this information (2008: 65). Communities are

strengthened when human well-being and productivity are increased via the use of sustainable building practices.

Heilman (2016: 134) made the point that it's critical to outline, organise, and list the numerous benefits of sustainable building. This was corroborated by Rahim, Yusoff, Zainon, Wang, and Lumpur (2014: 89), who stated that among the benefits of sustainable construction are lower construction costs, improved resource utilisation, and increased worker productivity. Hayles and Kooloos (2008: 4) have connected the benefits of sustainable construction to decreased energy costs, improved worker productivity and health, improved company reputation, and a more comfortable work environment. In the real estate industry, sustainable building practices improve building value, productivity, cut costs, and protect the environment (Liu et al., 2020: 7). In light of these, it is essential to clarify the benefits associated with the South African construction industry in order to maximise profits.

Hwang and Tan (2010) showed that when comparing green structures to normal/standard structures, the former have more benefits and yield higher profits. The Life Cycle Inventory Database for the United States explained that green buildings integrate methods to lower energy consumption, making them more energy efficient, refuting the aforementioned claim. More material frame vitality—which could make up as much as 30% of the total life cycle vitality used—is anticipated in superior structures. Better structures required less working energy, which explained this. Building materials with lower encapsulated imperativeness are wood shake and dull top, as opposed to robust materials like steel and squares. A green precast concrete manufacturing facility certified by the LEED green rating system experienced a 25% increase in production and a 30% decrease in vitality, according to Riesa's (2006) case study. According to Yudelson (2008), there were reasons why green buildings are desirable: they are more water-efficient, require less maintenance, have a higher property value, increase productivity in residential development, and have a 5% less non-appearance. The benefits of comfort, hazard, attraction, and intensity were also mentioned (Ojo-Fafore, Aigbavboa and Remaru 2018).

Zuo and Zhao (2014) carried out additional research in order to identify the objectives of interest associated with green structures that standard structures don't offer. One such favoured position is cosy and aesthetically pleasing. From a life cycle standpoint, the cost initiatives are also connected to increased building operational efficiency. In accordance, the

operating expense is prorated. Economists Zuo and Zhao (2014) claimed that compared to conventional structures, green structures could save up to 30% of energy. According to research conducted by Zuo and Zhao (2014), low-energy houses with green structures could save up to 55% of energy costs when compared to conventional structures. Despite the aforementioned viewpoint, Kats (2003) assumed in their article that the financial advantages of green structures outweighed the extra expenses incurred during construction by a factor of ten.

Ojo-Fafore, Aigbavboa and Remaru (2018) believed that the financial focus areas are lower costs for energy, surplus, and water; lower costs for regular and release; lower costs for operating and incentive; and higher prosperity and productivity. Another benefit that building occupants could take advantage of is warm luxury, which is made up of multiple interconnected components of temperature and humidity (Zhang and Zuo 2014). This required large brushstrokes, academic concepts to wear, and an examination of the cosy extravagance attempt in green filling in as unique and regular structures. According to Zhao & Zuo (2014), reduced energy, surplus, and water costs; lower regular and release costs; lower operating and incentive costs; and higher prosperity and productivity are the financial focus areas. Another perk for building occupants is warm luxury or thermal comfort, which is made up of various interrelated temperature and humidity components. This required using broad strokes, academic concepts to wear, and an examination of the luxurious yet warm attempt to fill in the green spaces as distinct and regular structures. According to Zuo and Zhao (2014), a body of research showed that green buildings offer a number of benefits such as eco-friendly.

Green structures, as opposed to conventional ones, are typically in charge of front-line and more significant execution that is diverted from energy-saving reserves, lowering carbon emissions, and conserving water, according to Henry and Frascaria-Lacoste (2012). Zuo and Zhao (2014) discovered that a remarkable amount of carbon dioxide released might potentially be reduced (resulting from energy sparing) if Leadership in Energy and Environmental Design (LEED) assessment realises were carried out in completely new advancement segments. Based on the analysis of Zuo and Zhao (2014), green buildings stood to gain the most from LEED certification in terms of lower nursery gas emissions and later adoption by conventional buildings. One of the special and genuine advantages of green building for people is the building's innate natural quality. The quality of the interior

environment, which includes waste products and unreliable releases of carbon-based composites, is another real stress in structures (Yu and Kim, 2010). As a result, environmental quality geographies are where green building valuation is realised (Chuck and Kim, 2011). Increased occupant well-being and financial success could result from green buildings' ability to achieve a higher standard of indoor environment quality than conventional ones, according to growing research. In a similar vein, occupants of buildings experienced increased and improved levels of comfort or fulfilment.

According to Goh and Rowlinson (2023), sustainable building projects have an impact on the finances of both external and internal project stakeholders. Determining the degree to which the transition to sustainability has a positive or negative financial impact on construction stakeholders could be aided by analysing the financial impacts of sustainable construction projects. Important stakeholders, such as developers and investors, are eager to understand sustainable building metrics from a structural and financial standpoint in order to effectively argue for the shift towards sustainability (Ries et al. 2006). Azapagic (2003) asserted that economic viability is crucial for the development of sustainable construction because it generates revenue, jobs, and ultimately advances social welfare in general. However, the costs and benefits of sustainable construction might not always match up with financial inflows and outflows when there are intangible costs and benefits involved. A more detailed examination of the initial cost in comparison to the ongoing or long-term benefits and cost savings is necessary to ascertain the relationship between sustainable building, business performance, financial return, and market mechanism (Ries et al. 2006). Many stakeholders, from project initiators at the top of the supply chain to end users, would be impacted by a sustainable construction project. Economic concerns are the top priority for most parties involved in construction projects, including employers, clients, competitors, shareholders, suppliers, contractors, consultants, and occupants, the study revealed.

Multiple stakeholders in sustainable construction might lead to principal-agent issues and split incentives, as Zhang et al. (2018) noted. Even though developers, clients, and end users played a significant role in determining the supply and demand for sustainable buildings, some stakeholders have reported a mismatch between costs and benefits (Deng and Wu, 2014). In order for the market to adopt sustainable construction practices more extensively, there are needs to be consensus among all stakeholders regarding the financial feasibility of these methods. Clients benefit financially from sustainable buildings because they are likely

to have higher exchange values and a longer economic life span than conventional buildings. For sustainable buildings, there are few risks related to potential increases in energy costs and stricter environmental regulations, such as the carbon emission tax (Reichardt, 2015). A few of the possible risks that could be avoided or mitigated are regulatory risks from required emission reduction targets, supply chain risks from transferred environmental costs, product and technology risks from competitor innovations, litigation risks from environmental lawsuits, and financial risks from declining asset quality and reputational harm (Lash & Wellington, 2007). Over a sustainable building's lifetime, project clients can also benefit from lower maintenance and operating costs. Sustainable building practices may also help a client's corporation gain a more favourable public perception of its environmental and social responsibility, which could ultimately boost the client's business.

Tan, Shen, and Yao (2011) found a link between a contractor's competitiveness and sustainability performance. It benefits businesses and gives them an advantage over their rivals in the green space. Developers who made sustainability investments stand, gain financially from improved public perception as a result of their proven social and environmental responsibility. Initiatives for sustainable building cultivate the goodwill of the developers, which created new opportunities for business. Developers who are able to charge a higher price for sustainable features stand to benefit economically, according to Urbecon (2008). More than half of the participants in a 2018 Dodge Data and Analysis survey agreed that sustainable buildings increase value at the point of sale. The respondents came from different countries. As stated by Fan, Chan, and Chau (2018), the government's economic incentive programme for sustainable development usually benefits developers because it provides them with low-cost loans, tax breaks, capital allowances, rebates, and rewards.

Deng and Wu (2014) found that residential developers bear all of the costs associated with sustainability investments and do not receive all of the corresponding benefits when sustainable homes are sold to households during the presale phase. According to their analysis, residential developers can only partially benefit from their sustainability investment and realise a smaller economic return, even though there was no evidence that doing so significantly improves financial performance. Developers would not profit from the resale stage, in particular, if sufficient financial benefits could not be obtained from the lump sum amount transferring during the presale stage (Deng and Wu, 2014). Robichaud and Anantatmula (2011) made similar claims, stating that over time, speculative developers lost

interest in managing or renting out sustainable buildings, and the benefits of operating savings ceased to be significant to them. Sustainable construction could have a positive financial impact on the project team, the report noted.

A report by Tan, Shen, and Yao (2011) claimed that contractors could grow their businesses by incorporating sustainable practices into their construction process. The sustainability concept increases contractors' competitiveness by promoting resource efficiency to lower production costs while maintaining profit margins and project values (Porter and Linde, 1995). For instance, because local materials are less expensive to transport than imported ones, utilising them during construction could reduce overall costs. These days, project clients are more aware of sustainability's benefits, and sustainability requirements are also included in the project brief. The project team might also face pressure from developers or clients to build with sustainability in mind. Construction professionals should also arm themselves with solid sustainability knowledge in order to meet client demands and prevent being incompetent in managing sustainable construction projects. Lu et al. (2013) reported that sustainable enterprises in the engineering and construction domain demonstrated heightened productivity and profitability due to efficient asset management and operation. Sustainable businesses had the potential to achieve 17.4% return on equity, which is one-time higher than the 8.2% average for conventional businesses from 2007 to 2009 (Lu et al., 2013). The authors also found that sustainable businesses outperform the competition by achieving incrementally positive values in economic profit and revenue growth, despite the fact that sustainable practices have not been successful in the financial market. The same study came to the conclusion that sustainable firms' superior financial performance was caused by favourable debt terms and high financial leverage. End users, which include tenants, owners, occupants, and facilities managers, are those who use buildings for the reasons for which they were designed. End users are greatly impacted by the design and development of construction projects because they are usually the ones who manage and use the built assets for the longest period of time. The most obvious and immediate economic benefit for end users is operational savings, which could lead to up to 30% cost savings from energy in commercial buildings (ASBC, 2016). As per Kibert (2016), end users also gain from less expensive upkeep, repairs, and other expenses related to sustainable buildings. Lower maintenance and repair costs for sustainable built assets could result from the use of more resilient and effective materials, such as fly ash concrete instead of standard concrete mix and fluorescent lighting systems instead of incandescent lights.

Furthermore, there were indirect economic benefits to sustainable building since it promotes safer and healthier living conditions for its residents. For example, employing eco-friendly materials for interior finishes like wall painting would improve health, cut down on medical expenses and claims, increase employee attendance and productivity, and lower insurance premiums by reducing harmful emissions into the environment (ASBC, 2016; Urbecon, 2008). From one perspective, building owners with sustainable buildings might be able to charge a higher rent premium than those without certification (Reichardt, 2015). Creating sustainable buildings is good for people's health as well as the environment and communities. The green initiative's implementation enhanced environmental protection in the building sector. Sustainable construction methods could help protect the environment by using resources more wisely and producing less waste and pollution. Sustainable construction practices had the potential to improve social and economic conditions in construction-related communities and industries by creating jobs and providing training opportunities. Construction techniques could also help make buildings and infrastructure more resistant to environmental threats like climate change, Fan, Chan, and Chau (2018) asserted.

According to Yudelson (2008), studies have demonstrated that the utilisation of sustainable construction techniques could lead to improved occupant health and general well-being. This is because interior air quality and natural light levels are higher in sustainable buildings. Sustainable construction practices often lead to the use of better construction technology. As a result, less dangerous building materials might be used, and construction procedures could become more effective and efficient. Adopting sustainable construction practices could improve construction management by promoting the use of more efficient building methods and materials as well as by improving coordination and communication amongst construction professionals. Buildings constructed using sustainable building practices could be less polluting, more environmentally friendly, water- and energy-efficient, and produce less waste. When compared to conventional buildings, sustainable building designs and constructions usually have lower operating costs. This is as a result of sustainable buildings' increased energy and water efficiency, the author maintained.

Windapo and Machaka (2018) revealed that the widely held belief among stakeholders that the cost of buildings obtained through sustainable construction initiatives is significantly higher than that of buildings constructed using conventional construction methods, despite the growing demand for affordable and sustainable buildings for residential and commercial

uses, is the basis for the justification of the examination. According to the study's findings, conventional and sustainable building types were thought to offer perceived cost benefits by industry stakeholders. They also thought that the cost difference between the two kinds of buildings was not as great. This refuted previous theories that proposed a significant cost differential between the two kinds of buildings. The study concluded that the government should encourage the development of sustainable buildings through incentives and legislation, given its ecological benefits and the insignificant cost difference between the two buildings. The study is important because it provided a business case to support the active development of sustainable buildings, given the minimal cost difference between conventional and sustainable buildings and the environmental benefits of sustainable building, the study indicated.

Sustainable construction encompassed various elements such as water efficiency, energy and atmosphere, materials and resources, building interior environment, sustainable sites, innovation, and construction process. Sustainable construction practices, according to Du Plessis et al. (2002), involved applying all green building principles from raw material extraction to waste deconstruction and disposal. Du Plessis et al. (2002) characterised conventional practices as an agenda that draws attention to the problems of poverty and underdevelopment by making greater use of environmental resources. The slow adoption of green building practices on construction projects, according to McNamara (2010), was caused by a variety of factors, such as people's or companies' attitudes towards their application, national economies, and technology; additionally, the costs borne directly and indirectly by real estate developers, construction companies, tenants, and owners; and finally, a lack of clarity from the government or other higher authority regarding the requirements of green building legislation. For example, this has led to the training of suppliers and staff of construction companies in green building methods and practices in order to guarantee adherence to environmental regulations. Despite possible advantages like lower maintenance costs, Ali (2009) claimed that an investor's green investment may take several years to pay for itself. Investors are often not convinced by green building practices because they believe they are more costly and have financial implications (UNEP, 2009). As per Kruse's (2004) analysis, there were calls for the construction industry to adopt green building practices in lieu of conventional construction methods due to their detrimental effects on the environment, including climate change. Environmental degradation and major climatic shifts like global warming that resulted in torrential rain and flooding were caused by the industry's

continued adoption of traditional building techniques like heavy lifting, on-site crane use, and electrical hot work.

The belief that green buildings are expensive and the absence of working documents compelling construction stakeholders to adopt green building practices is probably the main reasons why conventional building methods are still being used in South Africa. Although most people involved in the construction industry were aware of green building initiatives, they might not know exactly what constituted a green building practice or how much these projects actually cost in comparison to conventional projects (Kaplow, 2010). Studies conducted by Windapo and Goulding (2015) and Umar and Kamidi (2012) showed that most stakeholders are ignorant of sustainable construction initiatives and practices, as well as their proper place in these fields. Webb (2005) found that many green building experts saw green building practices as an energy-saving tactic and believed that materials are a more important factor than air quality and water efficiency. This point has also been highlighted by Umar and Kamidi (2012), Copiello and Bonifaci (2015), and Stephan and Stephan (2016), who discovered that energy efficiency is the main way that green buildings are perceived.

Jay et al. (2013) claimed that there is a link between the awareness problem and a lack of sustainability knowledge. Although ecological concerns were the main force behind sustainability, social and economic development are also included (Littig and Griebler, 2005). Windapo (2014) stated that the majority of green building initiatives are driven by economic considerations, and that balancing social and economic considerations with environmental ones could be difficult. Adopting green building practices has several advantages, according to Cruywagen (2013). The capacity to recycle construction waste for later use is one of them, as is the use of locally sourced building materials; reductions in light, noise, and air pollution; preservation of natural habitats; control of storm water runoff; low-maintenance and efficient building design; and use of less hazardous equipment and low-emitting materials on projects are some of the others.

According to the different aspects of life that green buildings affect, Suttel (2006) classified the potential benefits of these structures. The report continued by saying that early project collaboration between the design and construction teams is necessary to achieve these benefits. The study divided benefits into three groups: environmental, social, and economic. First among the environmental benefits of green building design are the enhancement and

maintenance of ecosystems and biodiversity. Green buildings, according to Du Plessis et al. (2002), put two things first: (1) enhancing the quality of the air and water; and (2) minimising environmental disturbance and damage during the design and construction phases. These elements showed how eco-friendly buildings cared about the ecosystem's ability to function. Improving a project's air and water quality is one of the nine requirements for obtaining a green star rating, according to the Green Building Council of South Africa (GBCSA, 2013). Thirdly, waste streams must be reduced. As parts were designed to fit together with minimal waste, designers need to ensure that their layout reduces waste as well as the conservation and restoration of natural resources. To put it another way, the design needs to be efficient enough to leave most of a tile unused, GBCSA (2013) indicated. Designers should select materials for a project based on what is easily accessible in the area when it is still in the design stage.

Lower operating costs are one of the financial benefits of green buildings. As an illustration, it is possible to reduce the operational cost of a high electricity bill that would arise from using conventional air conditioning (Wessels, 2012). The profitable trade in green goods and services is another important draw for the majority of investors or customers. The scarcity of green building products on the market today accounted for their high prices. Consequently, there was increased profit margin and decreased competition for green building products and services. One of the first social benefits of green buildings is an improvement in occupant comfort and health. For instance, the Cape Town green building project "The No. 1 Silo" improved air quality by using seawater naturally rather than air conditioning (Wessels, 2012); in addition, the building's aesthetic qualities were enhanced. A common characteristic of green buildings is their large glass windows, which provide an attractive appearance and an abundance of natural light. According to Osterberger et al. (2003), conventional construction is no longer adequate to give the current need for innovative materials as well as the growing complexity and scale of projects. Conventional construction is based on the construction of buildings with typical size and shape, "anticipated loading, common practices, and use of traditional materials."

According to Davis et al. (2008), conventional construction has benefits. These benefits include the accountability that results from competitive selection, which is based on a large pool of willing bidders and contractors, suppliers, consultants, and subcontractors in the construction market; previous construction task execution experience; tried-and-true

construction practices; and consultants' access to rates from past project estimates. Because historical data could be used, this made managing a traditional building project easier.

According to Weerainghe & Ramachandra (2018), a green building was designed to reduce its environmental impact from the materials used during their life cycle, improve indoor air quality, and use less energy and water. Therefore, a number of sustainable elements of green buildings, such as sustainable sites, management, indoor environmental quality, health and well-being, energy and water efficiency, materials and resources, etc., were associated with resource conservation (United States Green Building Council, 2009). The uptake of green building is far below the expected level due to a number of factors, including high initial investment costs (Nelms et al., 2005), underestimating potential cost savings, overestimating the capital costs of energy-efficient measures, and underestimating potential cost savings (Ala-Juusela et al., 2014). Evidence from Al-Hajj and Horner (1998) showed that many public and private organisations made investment decisions based on estimates of the initial construction cost. They rarely or never considered the costs of operation and maintenance during the building's lifetime. Because of this, improving the cost-effectiveness of green buildings is of interest to both owners and users, and it affects their decision to move forward with a project or not. Morris and Langdon (2007) also discovered that most buildings are capable of incorporating a reasonable degree of sustainable design at little or no extra cost. With consumer demand for carbon neutral products rising and environmental impact minimization becoming more and more important, an analysis was done to compare the LCC of two green buildings with an analogous conventional industrial building. The comparisons revealed that although the operating, maintenance, and end-of-life costs of green buildings were saved by 28, 22, and 11%, respectively, their construction costs are still 37% higher than those of conventional buildings.

After conducting a sensitivity analysis, it was concluded that green industrial buildings are financially viable. At different discount rates, an overall savings of 21% could be realised over the buildings' potential lifetime, according to Morris and Langdon (2007). Consequently, the findings of this study raised the bar for sustainability overall by enabling investors who care about the environment to make informed decisions at an early stage. In order to continue identifying sustainable features and their impact on LCC, the study's sample was widened to include a wider variety of industrial manufacturing buildings. Acknowledging the financial benefits of eco-friendly buildings over their negative aspects

would also assist eco-friendly investors in considering cost-effective sustainable elements and ultimately attaining sustainability. Furthermore, the increased use of green in manufacturing buildings would attract more customers especially the foreign ones.

2.2.1. The perceptions of stakeholders regarding sustainable construction, sustainable economy, and green economy.

Because sustainability might contribute to creating a more environmentally friendly world for future generations, sustainability in construction then is a crucial component of development (Freeman et al. 2010). Building sustainably means using recyclable and renewable materials, while also taking into account the environment near the construction site and the amount of energy and resources consumed. Although, economics with sustainability are not normally equated with each other, it plays a crucial role. Finding a healthy balance between economic growth and accountability, as well as not favouring it at the expense of social, environmental, or cultural concerns, is a key to having a sustainable economy. Minimizing wasted effort, time, and money could help huge corporations as well as the environment. According to the UN Environment Programme, a green economy is one in which public and private investments are made in assets and infrastructure that strive to minimize emissions, pollution, and biodiversity loss as well as to improve energy and resource efficiency (Limskul &.Hoa 2013). It is also low-carbon, resource-efficient, and socially inclusive, the study disclosed.

There are countless benefits to sustainability, but in order to make more comprehensible response, three pillars of sustainability are considered. Sustainable practices helped the environment by preserving life, lowering global warming and extreme weather, and maintaining Earth's resources (Díaz-López te al. 2021). It supports the economy by eliminating waste of time, energy, and resources while striking a balance between responsibility and growth. It also benefits everyone by boosting local economies and assisting society's most disadvantaged citizens (Cordano & Frieze 2000). In a culture that encourages extravagant consumption and relentless materialism, not just from major corporations but also from some governments, making sustainable decisions could be difficult (Erika et al. 2020).

As a major construction stakeholder in all public projects, the government has the power to establish policies and guidelines for environmentally friendly building practices through its regulatory bodies (Windapo & Goulding, 2015; DPW, 2007). Other stakeholders that have an impact on the planning and construction of a project are members of the design team. The design team members influence the project's financial aspects, materials selection, disposal procedures, and overall design (McNamara, 2010). Among the other parties actively pushing environmental and green building construction are non-governmental organizations (NGOs) and community-based organizations (CBOs). DuPlessis et al. (2002) stated that these groups usually carry out a "watchdog role," which comprised keeping an eye on and evaluating matters about the environment and climate.

According to Windapo and Machaka (2018), construction scholars held the view that green buildings—which are the culmination of sustainable construction—have extremely high construction costs. For example, the initial costs of a green building are either slightly higher or comparable to those of conventional structures, according to Adamson's (2004) study. Kaplow (2010) conducted a study on 107 projects in New York City and found that 63 of the projects used green building techniques under the LEED rating certification, which is a recognised green building rating in the US. The study also showed that conventional buildings cost $436 per square foot, whereas green building projects cost $440. Furthermore, compared to conventional projects, the median cost of design fees for green-star rated buildings was $0.56 per square foot. According to a related study by Cruywagen (2013), the cost difference between conventional and green buildings is approximately 7.58%. This is based on a case study of a four-star green building in Johannesburg, South Africa, that was upgraded to a five-star building. It also discovered that as green building techniques improve, costs decrease. According to Du Toit (2014), those who were dubious about sustainable construction methods argued that there are substantial costs associated with creating a green building. On the other hand, proponents of green buildings, such as Matthiessen and Morris (2004), asserted that these additional costs could be quickly recovered due to the green building's faster lease-up, higher rental rates, and increased market value.

Furthermore, Matthiessen and Morris (2004) argued that by using seasoned green building consultants for project design and oversight, additional costs typically associated with green buildings can be minimised and project costs could be managed. Furthermore, if the developer or investor intends to build another building, it might be advantageous for them to use the same design and supervision team, according to the Natural Resource Defence

Council (NRDC 2014). The benefits that investors and occupants experience after the project is completed, in the opinion of Matthiessen and Morris (2004), exceeded the slight cost difference between the two construction types. They continued by saying that the amount of the cost difference would depend on the building's sustainability and design. Suttel (2006) agreed, saying that green buildings could be constructed for little to no extra money as long as the original design is finished completely. Suttel (2006) also claimed that the general public's perception that green buildings are more expensive than conventional ones and the continued use of conventional construction techniques are the outcomes of the dearth of information regarding the relative costs of conventional versus green buildings and vice versa.

According to Mashwama et al. (2019), a sustainable practice (SC) is completing construction projects within budget and protecting the environment, including the social welfare of the occupants. Azis et al. (2012) noted that social stability necessitates a dedication to economic stability, which entails the efficient use of labour, materials, energy, water, and resources, environmental stability, which also entails using resources while protecting the environment, and social stability and which ensures that residents receive satisfactory results. For example, Al-Sanad (2015) questioned the idea that SC could meet current demands without depleting resources for future generations.

The SC is prioritising the construction of energy-efficient and environmentally friendly buildings, as stated by Mashwama, Nokulunga & Thwala, Wellington & Aigbavboa, Clinton & Hamma-adama, Mansur (2020). Choosing the proper materials is part of this (Kádárová et al., 2015) added. The concepts and technologies of SC promote sustainability and produce better, more satisfying construction and post-construction results. Many opportunities that nanotechnology presents could aid in the creation of novel materials with a variety of applications. Additionally, the design, construction, and application of functional structures with nanoscale dimensions were covered by Ametepey and Aigbavboa (2014). Every phase of the material production process, from organisational operations to urban development, could benefit from an analysis of the ecological footprint. The term "ecological footprint" refers to the area of land that could be used for agriculture, ecosystems, and human activity (Cole, 2000). As stated by Cole (2000), a construction method known as "Building Systems" (IBS) involves manufacturing components under controlled conditions, either off-site or on-site, and then assembling, rearranging, and assembling them into a structure with the least

amount of additional site work. IBS helps with cost savings, waste reduction, and improved project delivery (Kamar et al., 2009).

According to Marques and Loureiro (2013), the primary goal of life cycle assessment, or LCA, is to meet customer needs while balancing the needs of the product with the environment. During green market-focused product development processes, LCA is used to identify engineering solutions that would help achieve the goal of sustainable construction (Kádárová et al., 2015). To ensure strategic planning, identify new opportunities for a successful project, take sustainable construction n principles into account, and satisfy client needs with the least amount of environmental impact, LCA must be integrated from the beginning of planning design. Building information modelling (BIM) is a cutting-edge technique that promotes off-site production and collaborative working, both of which reduce waste, according to Hammaadama and Kouider (2018). Digitally machine-readable records of a building's performance, design, construction, and subsequent operation support building information modelling (BIM) processes and technologies (Tauriainen et al., 2016).

Environmental, health, and safety goals are systematically taken into account by design for environment (DfE) throughout the whole life cycle of a product or process (Cole, 2000). DfE's attributes also include encouraging the development of eco-friendly materials, lowering the energy required to manufacture products, and utilising less material (Marques & Loureiro, 2013). According to Reddy (2016), life cycle costing, or LCC, makes strategic cost control possible from the start of building to the conclusion of demolition. In order to provide value for money, LCC would be used to compare design options based on asset whole life cost (Kádárová et al., 2015). Ecological economics seeks to comprehend the interactions between human and natural systems in order to create practical regulations that could be put into place to safeguard resources and guarantee their equitable distribution (Nahman, 2009).

The global "green building" movement is referred to as construction ecology, according to (Kibert et al., 2012). The construction ecology was acknowledged as a means of mitigating all the negative effects accruing because it addresses pollution, waste management, water management, recycling, reusing, and most importantly, energy efficiency (Windapo, 2014). Using nature's most useful structures and mechanisms to solve human problems is the aim of the biomimicry approach. This is accomplished not only by imitating the structures of evolved organisms but also by offering solutions for energy supply, waste management, and

structural efficiency (Mirniazmandan & Rahimianzarif, 2017). According to Tauriainen et al. (2016), lean construction maximises project productivity and transparency by eliminating waste from the construction process. Value management (VM) is an end-to-end service that maximises functional development by auditing and comparing every decision to a value system that the client or customer specifies. In the critical phases of a project, Al-Sanad (2015) recommended applying the VM theories to maximise resource utilisation and minimise waste. Although infrastructure development and economic expansion have greatly benefited communities, the fast expansion of construction activities has also had detrimental effects on the environment and increased pollution because of construction waste.

In addition to minimising negative environmental effects and enhancing sustainability, sustainable building practises also lower operating costs and boosts output. Research has demonstrated the impact of sustainable building practices on the well-being and productivity of workers. It was advised that stakeholders received workshops and training due to the low level of awareness. The government ought to provide tax breaks and other advantages to companies that adopt the SCP. According to Osterberger et al. (2003), conventional construction is no longer appropriate due to the increasing complexity and scale of projects as well as the current need for innovative materials. Conventional construction is based on the principles of "anticipated loading, common practices, use of traditional materials. It also involves building structures with standard sizes and shapes.

Conventional construction has advantages, according to Davis et al. (2008). These advantages include the accountability that arises from competitive selection, which is predicated on a sizable pool of suppliers, consultants, and subcontractors in the construction market; prior experience in the execution of construction tasks; well-trod construction methods; and the availability of rates from previous project estimates for consultants. This facilitates management. The general practices of conventional building construction are carried over from project to project even though the techniques might not be appropriate for the particular project at hand because conventional construction was based on history and it could be challenging to determine when the techniques are insufficient. Other detrimental consequences of one-size-fits-all construction have been documented, such as the perpetuation of ineffective practices like resource waste and mismanagement (Osterberger et al., 2003; Tam et al., 2007).

A green building aimed to reduce the environmental impact of its material life, use less energy and water, and improve the quality of the air inside. According to Weerainghe and Ramachandra (2018), there was a connection between resource conservation and a number of sustainable aspects of green buildings, such as materials and resources, energy and water efficiency, indoor environmental quality, health and well-being, sustainable sites, management, etc. Adoption of green buildings is far behind expectations for a number of reasons, such as high initial investment costs (Nelms et al., 2005), a lack of awareness among a broader audience about significant operational cost savings, an overestimation of the capital costs of energy-efficient measures (Ala-Juusela et al., 2014), and an underestimation of potential cost savings. There was proof that many public and private organisations based their investment decisions primarily on estimates of the original construction cost, paying little to no attention to the costs associated with operation and maintenance (O&M) over the building's lifetime (Al-Hajj and Horner, 1998). As a result, increasing the financial viability of green buildings is important to owners and users alike, and it influences their choice to proceed with a project or not. Morris and Langdon (2007) also found that, for little or no additional cost, most buildings can incorporate a reasonable level of sustainable design. The increasing demand from consumers for carbon-neutral products and the growing significance of minimizing environmental impact has led to the adoption of green building concepts in Sri Lankan industrial manufacturing buildings. In light of this, a comparison between the LCC of two green buildings and a conventional industrial building that is comparable was conducted. Despite the fact that green buildings save money on operations, maintenance, and end-of-life expenses by 28, 22, and 11%, respectively, the comparisons showed that the construction costs of these structures are 37% greater than those of conventional buildings, the report indicated.

According to sensitivity analysis done by Ramachandra & Weerainghe (2018), green industrial buildings could be made financially viable if they could save up to 21% of the total cost over the course of their potential lifetime at different discount rates. Therefore, by enabling green investors to make informed decisions at an early stage, the study's conclusions elevated the standard for sustainability in general. Buildings that used more green technology in their industrial manufacturing would attract more customers, especially from abroad. The construction industry has been viewed as a crucial player in advancing sustainable development due to its awareness of the substantial effects that social and environmental development have on society. Nonetheless, there are still notable variations in how

sustainable construction is implemented across practices, especially when taking into account stakeholder disputes about definitions and guiding principles (Yip, Rowlinson, and Goh 2013). The application of sustainable development is greatly aided by sustainable construction. The environment, society, and economy are generally recognised as the three primary pillars of sustainable development and construction, even though stakeholders are still debating the precise meanings and guiding principles of these concepts. Construction stakeholders always have different priorities and weightings on their sustainable construction agendas due to differing exposures and interests, which frequently leads to conflicts among the stakeholders. This study discovered that although cost and social perspectives aren't always taken into consideration, the environmental pillar is always included in the definition of sustainable construction. The relationship between sustainability and carbon footprint is widely established. A significant portion of how social and economic issues are incorporated into the development of sustainability is determined by the stakeholders' backgrounds and experiences. For example, urban planners and urban landscape architects, who have always prioritised macro development, often take the social pillar into account. Understanding how the triple bottom line and sustainable construction interact better is crucial because it could spur construction stakeholders to adopt more sustainable practices. When conflicting goals are set by various interested parties due to their divergent interests, there would be a gap in sustainable practices.

By having a better understanding of the overall evolution of the concepts of sustainable construction, practitioners could better shape their future directions and strategies and raise the majority sustainability performance in the construction industry. While organisations understood the advantages and needs of adopting sustainable construction, the primary driving forces behind its adoption in construction practices are legal and environmental obligations. According to Fellow and Liu (2008), institutional influences and environmental protection laws that support moral behavior—including environmental protection—and deter unethical behaviour through social and financial penalties are the driving forces behind sustainability certification programmes.

It is not surprising, claimed Goh, Rowlinson, and Yip (2013) that construction companies have an inherently environmentalist perspective on sustainable development. The situation becomes even more contentious when one considers how the current sustainability assessment systems prioritise the environmental aspect over the other two

pillars in the name of sustainable development. Beheiry & Associates (2006) argued that because business executives have historically preferred environmental sustainability over sustainable development, they have grown distant from the green movements. This viewpoint was reinforced by Fellow and Liu (2008), who claimed that "legislation is piecemeal and addresses greening rather than sustainability." If achieving a triple bottom line goal is not achieved, the project's sustainability as development is compromised. Taking everything into account, national laws that make reference to standards are believed to have a stronger effect. Nevertheless, businesses in the consumer goods, mechanical engineering, electrical engineering, and metal production sectors have found that unspoken rules set by one or two companies without the involvement of other pertinent parties can backfire. Philipp Heß and Knut Blind (2023). The experts in charge of the national standardisation body rated consortium standards published by multinational, frequently industry-driven organisations lowest for their impact on the SDGs in the areas of professional and scientific services, certification and testing, electrical engineering, and metal production. They emphasise how important standards, also known as bylaws, are to adhere to and how many businesses and other organisations see it as practically necessary for standards to be followed. Therefore, laws that support sustainable development objectives work especially well when they are enshrined in consistent standards.

It was discovered that the areas that benefited most from standards were healthy living, sustainable cities and communities, clean water and sanitation, and addressing climate change. These objectives pertained to heavily regulated industries where standards are most likely connected to public regulations. Standards that are deemed to be more effective than those attributed to the very beginning of the value chain, as presented by Montiel et al. (2021), would become apparent when reexamining how the SDGs are clustered along the value chain and dividing them into promoting positive and reducing negative externalities. It is widely acknowledged that the Sustainable Development Goals are more likely to be achieved, if standards are required by national or European law.

The number of ISO standards allocated to each Sustainable Development Goal (SDG) is taken into account when comparing stakeholder opinions regarding the goals' relevance (Knut Blind and Philipp Heß 2023). Removing inconsistent public regulations and improving the coordination of regional goals are priorities. Using international standards would encourage nations that place more importance on other matters than sustainability to step up their

efforts. The interesting thing is that stakeholders seem to disagree about how much standardisation differs from certain "practitioners" (especially in the construction and consumer goods industries), "theorists" (science, associations, and testing), and "insiders" of standardisation (certification and testing). This implies that standardisation could be able to help the SDGs more successfully than it presently could.

According to Ezeokoli et al., (2023), sustaining current needs without sacrificing the capacity of future generations to meet their own is known as sustainable development or SD. Comprehending this phenomenon, also known as SD, is crucial for the housing sector. The environment, society, and economy—the three pillars of sustainable development—also apply to other domains, such as politics, institutions, and culture. The idea of SD is frequently ignored and undervalued in the housing sector in the Nigerian state of Anambra. Although the terms sustainability and SD are frequently used interchangeably, they refer to two different ideas. Because of its inherent complexity, normative character, subjectivity, and ambiguity, sustainability is a contentious concept. The authors believed that sustainability is distinct from other forms of policy due to the integration's essentially fixed notion. Incorporating sustainable concepts into every stage of the home development process is key to creating and sustaining a long-term supply of high-quality housing at the most affordable price. Because housing has so many different aspects—social, cultural, economic, and environmental—it could improve sustainability on a local, national, and international level as well as environmental protection. The aim or result of the process known as sustainable development is sustainability. When it comes to the construction of housing projects, sustainability in housing aims to address the sustainability of environmental, economic, social, and cultural concerns, according to the report, SD is a challenging, vague, and individualised idea. Incorporating sustainable concepts into each stage of the house-building process is the best way to create and preserve a high-quality stock of buildings in the future. In housing developments, more integration and incorporation of SD is needed. Housing projects are implementing SD principles in order to attain sustainability in the process of delivering housing projects. Construction-related experts and authorities ought to be knowledgeable about SD and SHD. This is a step in the right direction for the housing industry to achieve SD. Sustaining current demands without jeopardising the ability of future generations to meet their own is the aim of sustainable development, or SD. The housing industry needs to educate people about SD and related phenomena. Honour the principles of

social, environmental, and economic development; other spheres, like politics, institutions, and culture, could also be involved.

The building sector has evolved over time to become the main source of carbon emissions, according to Berawi et al. (2019). In the United States, buildings accounted for over 40% of greenhouse gas emissions, more than the transportation and industrial sectors combined (USGBC, 2016). Energy sources used in commercial buildings include electricity (61%), natural gas (32%), district heat (5%) and fuel oil (2%), according to the US Energy Information Administration (2012). Most OECD members have the highest emissions even though their economies are growing slowly. However, developing nations—mostly in Asia—are seeing rapid economic growth and are catching up to OECD nations (Lucon et al., 2014).

To combat the rising amount of carbon emissions, policies and regulations have been developed over the past thirty years using an environmentally friendly concept in the building (Trencher et al., 2016). The idea originated primarily from long discussions and debates about how to reduce the negative environmental effects of buildings by increasing building efficiency and controlling the development of resources, energy, and space. One idea to promote eco-friendly practices in the construction industry is green building. It could be quantified by means of specialised evaluations such as ecological, social, and economic ones. Kibert (2016) established commercial quality standards that address everything from life cycle cost reduction to economic value preservation.

The high labour and investment costs in the commercial building industry highlighted the significance of building quality. Notwithstanding the benefits of the idea, stakeholders in Indonesia, including developers and owners, were hesitant to incorporate it into their projects because of the related expenses and their lack of knowledge about sustainable practices. According to Caesario (2016), there was a 10% to 15% cost difference in the nation between conventional and green building. Modern technology, eco-friendly materials, and elegant designs make the extra expense worthwhile (Zhang et al., 2011; Hwang and Tan, 2012). Sertifikasi Bangunan Hijau (2017) listed buildings in Indonesia that were certified as silver, gold, or platinum. Scholars and researchers have examined the technical, financial, environmental, and social aspects of green building (Hill and Bowen, 1997; Medineckiene et al., 2015; Shad et al., 2017). The claim that stakeholders, especially in Indonesia, comprehended the fundamentals and real-world applications of sustainability and green

building certification, however, is not well supported by data. Sustainability, according to some interpretations, is about how current activities interact, cooperate, and work in tandem with the conservation of natural resources for the benefit of future generations. The United Nations World Commission on Environment and Development (WCED) first raised the issue of the need to find a long-term solution to reduce ecological degradation and promote energy conservation in its 1987 Brundtland Report. The conference of parties (COP) was held in 1995 and is still going strong today. Significant environmental policies have been produced by the yearly meetings; these include the Kyoto Protocol in 1997 and the Paris Agreement in 2015 (Rogelj et al., 2016).

Sustainability is viewed in the building sector as a means of protecting the environment. Despite its fluidity, the concept of sustainability is primarily based on three dimensions: social, economic, and environmental (Kibwami and Tutesigensi, 2016). According to Shi et al. (2013), the environment in sustainable construction includes controlling waste, emissions, using renewable energy, using toxic-free materials, and many other factors. These were employed to improve human welfare and decrease the negative effects of human activity. The environment is taken into consideration by designers when creating buildings with eco-labelling performance.

According to Ding (2008), building owners could be divided into two groups: those who prioritise safety, comfort, and health, and those who want to maximise profits from their properties in a specific amount of time. It is possible that a sustainability concept would reduce the difference in expectations between the parties. According to Shi et al. (2013) and Trencher et al. (2016), building owners could benefit from a concept that offers low operating costs along with improved indoor health, air quality, visual appeal, and security through sustainable construction. The concept of the human being, the consequences of civilization, and the standard and comfort of living all have an impact on the social aspect (Edum-Fotwe and Price, 2009; Dempsey et al., 2011). Workplace design and environmental interventions, for example, could have an impact on social interaction. Since there are fewer walls dividing the rooms in an open-plan office layout, staff members could communicate more effectively and the central building could receive more natural light (Kim and De Dear, 2013). In situations where privacy is crucial, an enclosed footprint plan might be used. Windows, doors, glazing, and the building envelope are a few instances of passive energy-saving

measures. One of the active energy-saving strategies is the development of automated systems (Sadineni et al. 2011).

Working together, social interaction and environmental awareness could strengthen society's economy (Pugh, 2014). A traditionalist who believed that protecting the environment would take more money, be more difficult, and take longer to pay off,Tan et al. (2011) provided examples of two phenomena that connected prosperity and a favourable environment. On the other hand, revisionists argueg that environmental aspects could give businesses a competitive edge. Innovation and new technologies could be used to create interest and establish a new market by being the pioneers in that market, according to Porter and Van der Linde (1995). While there was continuous discussion among experts and practitioners, many thought that boosting a country's competitiveness requires understanding sustainability and its components (Berawi et al., 2016; Balkyte and Tvaronavičiene, 2010). Weingaertner and Moberg (2014) asserted that environmentally conscious design and sustainable construction are related. By utilising specific materials, energy sources, and spatial arrangements, it seeks to minimise any negative effects while simultaneously increasing productivity. Awareness of sustainability needs to be raised right away because the buildings that are designed now would have an impact on future growth. In the planning stage of a construction project, it necessitates the collaboration of relevant parties. The utilisation of contemporary, ecologically friendly technology and renewable energy sources should be considered during the project drafting phase. After that, the use of non-renewable materials, greenhouse gas emissions, and water scarcity in both urban and rural areas have led to a number of sustainability concerns, and as a result, the field of green building has grown quickly (Ramírez-Villegas et al., 2016; Aktas and Ozorhon, 2015). The 1970s oil crisis was when the industry initially began to take shape. The idea is now being applied all over the world as a crucial strategy to save the environment and preserves life.

According to Cassidy (2003), green building is an effort to maximise building efficiency while taking into account natural resources and to improve human settlement throughout a building's life cycle. A green building is defined by the International Initiative for a Sustainable Built Environment as one that achieves indoor environments, uses less energy and greenhouse gas emissions, and has a negligible ecological impact. A development in high-performance building design that focuses primarily on energy and water usage, green building aims to counteract climate change, environmental degradation, and the depletion of

natural resources. The US Environmental Protection Agency released this information in 2016.

Green building, according to Robichaud and Anantatmula (2010), is a tactic to lessen negative environmental effects, improve human well-being, encourage economic development, and imply public prosperity. According to that definition, the main objectives of green buildings are to protect human welfare well into the future and to support the concept of sustainability by fusing the environmental value of buildings with their economic and social worth. It's true that the initial cost of green buildings might be higher than that of traditional ones. On the other hand, less maintenance and operation would be required, eventually offsetting the initial costs. Robichaud and Anantatmula (2010) added that green buildings could lower operating costs by 8–9%, raise building value by more than 7.5%, and increase occupancy rates by 3.5%.

According to Wen S. and Qiang G. (2022), the global construction industry's massive energy consumption and negative environmental effects have brought attention to the significance of sustainable building. Consequently, many countries now considered the creation and design of green buildings to be standard practice (Hwang and Tan 2012). Optimising resource use for building projects over the course of their entire life cycle is the goal of green building practices. Darko et al. (2019) added that green buildings also enhanced people's quality of life, lessen pollution to the environment, and eventually support society's sustainable development.

A few of the complex elements that characterize green building projects (GBPs) are high-level sustainability goals, a large number of stakeholders, a multitude of uncertain risks, and strict technical evaluation indicators (Zhao et al., 2016; Mok et al., 2018; Bohari et al., 2020). Even though the relationships between GBP stakeholders have been the subject of multiple studies (Doloi 2013; Seuring and Gold 2013; Yang and Shen 2015; Li et al., 2018), it is challenging to decide how to address the issues brought on by the complex relationships between stakeholders in construction projects (Yang et al., 2020; Lin and colleagues, 2019). This was a result of the prior research primarily isolating stakeholders and social sustainability. The implementation of a disjointed approach like this compromises sustainability and negates the collective influence of the intricate interplay of stakeholder concerns (drivers). In actuality, taking into account more human activities is required to meet

the social sustainability goals related to green building; stakeholder involvement is also more crucial to the project's success (Mok et al., 2017). Research indicated that a project's success might face several challenges due to the diverse concerns held by stakeholders and their intricate relationships. According to Hwang and Ng (2013) and Luo et al. (2017), this caused the complexity of managing stakeholders to rise. Further complicating stakeholder management is the growing demand for sustainable knowledge and technology (Schröpfer et al., 2017). The goals of social sustainability are impacted by these difficulties. Thus, planning stakeholders' participation while taking into account their various concerns, and managing this relationship throughout the project are essential for project decision-makers.

The literature on GBP management made extensive use of stakeholder management; however, Qiang et al. (2021) pointed out that the current framework ignored the interdependency between social sustainability and stakeholder concern complexity. Stakeholder management offered a systematic approach to assess sustainability, which explained why. Despite a large body of research on sustainability assessment indicators, social sustainability indicators for GBPs have not yet attained broad consensus (Chen et al., 2015). According to Zhong and Wu (2015), Chong et al. (2016), Olanipekun et al. (2017), Yadegaridehkordi et al. (2020), and others, the degree of social sustainability of GBPs could be evaluated using social sustainability evaluation indicators, which are useful instruments for decision-making that support sustainable development. Buildings have to meet strict evaluation criteria in order to be classified as socially sustainable. According to San Cristóbal et al. (2018), the complexity of the project frequently causes discrepancies between the final goal and the actual decision-making process. A variety of stakeholder concerns and sustainable assessment indicators are available. Their intricate relationships frequently alter when they are combined, which makes decision-making more difficult. Unfortunately, the body of knowledge regarding network analysis and conventional assessment methodologies that is currently available in stakeholder management is inadequate and unable to offer practical solutions to issues.

The body of recent literature has extensively studied the idea of social sustainability. However, opinions on the social sustainability metrics of green buildings differ (Goel et al., 2020). Determining the most important sustainability indicators that could be used to evaluate the social sustainability of green buildings at every stage of their life cycles is therefore essential. Implementing GBPs in the context of sustainable technology is practically difficult.

Because there are so many stakeholder concerns, it could be very challenging to identify them at every stage of the project life cycle. Complexity of stakeholders could lower the sustainability level of GBPs by making decision-making more difficult.

Goh, Rowlinson, and Yip (2013) found that because the construction sector recognises the significant effects that social and environmental development have on society, it has been seen as a major player in promoting sustainable development. However, there are significant differences in the extent to which sustainable construction is applied across practices, particularly considering the disagreements among stakeholders regarding definitions and guiding principles of sustainable construction. To meet their own unique needs and concerns, various stakeholders and professions adopt various definitions and interpretations of sustainable development. Given that the construction industry involved the integration of people and the working of various sectors together, a comprehensive definition of sustainable construction is required to ensure that any particular needs of the stakeholders are not overlooked. By developing a deeper understanding of the holistic development of sustainable construction concepts, practitioners would be able to more effectively shape their future strategies and directions, which would ultimately lead to an increased level of maturity in sustainability performance within the construction industry.

Sustainable construction plays a major role in supporting the implementation of sustainable development. The environment, society, and economy—the triple bottom line—are widely acknowledged as the cornerstones of sustainable development and construction, even though definitions and guiding principles of these terms are still contentious among interested parties. Due to differing exposures and interests, construction stakeholders always have different priorities and weightings on their sustainable construction agendas, which frequently results in conflicts among the stakeholders. This study found that the definition of sustainable construction always includes the environmental pillar, even though cost and social perspectives aren't always taken into account. Most people understood sustainability to be related to the following: waste management, energy use, water use, material use, carbon footprint, and use of renewable resources. How economic and social concerns are integrated into the development of sustainability is largely determined by the background and experience of the stakeholders. Urban planners and urban landscape architects, for example, who have always placed a high priority on macro development, often consider the social pillar (Berawi et al., 2019).

Gaining a deeper understanding of the interplay between the triple bottom line and sustainable construction is essential, as it could motivate construction stakeholders to increase their commitment to sustainable practices. There would be a gap in sustainable practices when different interested parties set competing goals as a result of their different interests. By having a better understanding of the overall evolution of the concepts of sustainable construction, practitioners could better shape their future directions and strategies and raise the maturity of sustainability performance in the construction industry. While organisations are conscious of the benefits and requirements of implementing sustainable construction, legal and environmental obligations are the main forces behind its adoption in construction practices. Environmental protection laws and institutional influences that support moral behavior—including environmental protection—and deter unethical behaviour through social and financial penalties, according to Fellow and Liu (2008), provided a constant source of inspiration for sustainability certification programmes. It should therefore not be surprising that building companies typically approach sustainable development from an environmental standpoint. The fact that current sustainability assessment systems typically gave the environmental aspect more weight than the other two pillars in the name of sustainable development makes the issue even more divisive. Beheiry et al. (2006) claimed that, because environmental sustainability has historically received so much attention, business executives are now furious about sustainable development. Fellow and Liu agreed, arguing that "leg legislation is piecemeal and addresses greening rather than sustainability." A project loses its status as sustainable development if it fails to achieve one of the triple bottom line objectives.

All things considered, according to Knut Blind and Philipp Heß (2023), standards that were mentioned in national or European laws are thought to have a greater impact. However, businesses engaged in the production of metal, consumer goods, mechanical engineering, and electrical engineering have found that de-facto standards set by lone or small groups of businesses without the input of other stakeholders have even the potential to be harmful. Concerning their impact on the SDGs in the areas of professional and scientific services, certification and testing, as well as electrical engineering and metal production, the experts involved in the national standardisation body gave consortium standards published by multinational, often industry-driven organisations the lowest evaluation. The emphasis placed by the respondents on the relationship between public regulation and, in particular, the perceived relevance of harmonised European standards, suggests that standards that are a part of co-regulation hold particular promise for improving the diffusion of sustainability goals in

the industry. The integration of (primarily) industry stakeholders through standard-setting organisations under the EU's New Approach is a well-established co-regulative model that has demonstrated success in striking a balance between technological advancement and economic and societal goals. Laws should include sustainable development objectives in their standards. By doing so, industry expertise would be tapped into to create more concrete technical guidelines than the SDGs' imprecise definitions, which are perceived to "lack the precision and clarity needed to meet sustainability challenges" (Yamane and Kaneko, 2022; Vandemoortele, 2018).

The development and market diffusion of such standards could, in accordance with the Brussels effect (Vogel, 1997), anchor and diffuse sustainable practices in the industry, potentially beyond EU borders (due to requirements for accessing the Single Market and coercion in supply chains). Formal standardisation offers well-established platforms and procedures, lending legitimacy to its regulations and promoting their widespread adoption. Because formal standardisation is closely related to public regulation, it could serve as a bridge and guide industrial sustainability beyond the direct actors involved. By integrating the interests and knowledge of various stakeholders and advancing the mainstreaming of sustainable technologies and practices, formal standards that actively consider the SDGs might lead to industries that have not previously placed much emphasis on sustainability becoming more sustainable.

Ezeokoli, Ehimioboh, Okoye, and Ekekezie (2023) defined sustainable development (SD) as meeting current demands without compromising future generations' ability to meet their own. Understanding this phenomenon, or SD, is critical to the housing sector. The three pillars of sustainable development—environment, society, and economy—also apply to other realms, such as politics, institutions, and culture. In the Nigerian state of Anambra, the notion of SD is frequently overlooked and underestimated in the housing market. Although the phrases sustainability and SD are frequently used interchangeably, they represent two distinct notions. Sustainability is a contentious issue due to its inherent complexity, normative nature, subjectivity, and ambiguity. Sustainability policy differs from other policy kinds in that it is founded on the essentially fixed concept of integration. Creating and maintaining a long-term supply of high-quality housing at the most affordable price requires incorporating sustainable concepts into all stages of the home development process. Housing, with its social, cultural, economic, and environmental dimensions, has the potential to improve local and global

sustainability as well as environmental preservation. Sustainability is the goal or result of the process known as sustainable development. The goal of sustainability in housing is to address the long-term viability of social, cultural, economic, and environmental challenges in housing project design and construction. The survey discovered that 100% of respondents thought the idea of SD was subjective, vague, and difficult. The most effective strategy to generate and preserve a high-quality stock of buildings in the future is to include sustainable ideas into every phase of the construction process. More integration and assimilation of SD is needed in housing construction. To ensure sustainability in the housing project delivery process, SD concepts are being used.

The specialists and authorities in charge of construction in the study area should be thoroughly familiar with the principles of SD and SHD. This is a step in the right direction toward achieving sustainable development in the housing sector within the study area, as mentioned by Aldous (1992), Anink et al. (1996), Brandli et al. (2006), Chiu (2006), Grey (2010), Makinde (2020), Rotman (2006), and Stevenson and Williams (2005). Sustainability is the process of meeting present needs without endangering the ability of future generations to meet their own. The housing industry needs to be more cognizant of this phenomenon, known as sustainable development (SD). In addition to the environmental, social, and economic pillars, SD could also incorporate elements of culture, politics, and institutions. In Anambra State, Nigeria, the housing sector undervalues and ignores the concept of sustainability (SD). Despite their occasional interchangeability, the two terms are not the same. Similar conclusions have been drawn by Aldous (1992), Anink et al. (1996), Brandli et al. (2006), Chiu (2006), Grey (2010), Makinde (2020), Rotman (2006), and Stevenson and Williams (2005). Clients defined sustainable development as development that meets present needs without endangering the ability of future generations to meet their own. 97% of respondents agreed that there was a need to increase awareness of this phenomenon (SD), with a value of 0.97 for this factor. This finding is consistent with research from Kate (2001) and Hak et al. (2016).

According to Oyewole, Komolafe, and Gbadegesin (2023), sustainable building connects the realities of climate change with the built environment's protection principles. Research has indicated that there is a strong incentive for stakeholders in developed and some emerging

economies to invest in sustainable building practices. However, not much research has been done on the attitudes of key players in the market towards sustainability attributes, their propensity to incorporate sustainable elements, and the acceptance of sustainable policies in the development of residential real estate in sub-Saharan Africa. The study found that different stakeholders have different needs. Because these factors are more significant to them when making decisions about the adoption of sustainable buildings in developing nations, it is necessary to educate all relevant parties about the qualities of sustainable buildings, particularly their extra-environmental advantages.

According to Miraj, Windrayani, and Berawi (2019), the construction sector has been identified as the main source of carbon emissions over time. Buildings contribute approximately 40% of all greenhouse gas emissions in the US, more than the transportation and industrial sectors put together. This information was reported by USGBC (2016). The energy sources used in commercial buildings are as follows: electricity (61%), natural gas (32%), district heat (5%) and fuel oil (2%), according to the US Energy Information Administration (2012). Despite their sluggish growth, the majority of the highest emissions were produced by OECD members. Nonetheless, developing countries—mostly in Asia—are growing quickly and catching up to OECD countries (Lucon et al., 2014). Over the past thirty years, policies and regulations have been developed using an environmentally friendly concept in the building to combat the rising amount of carbon emissions (Trencher et al., 2016). The concept is principally the result of lengthy conversations and arguments concerning how to improve building efficiency and regulate energy, resource, and space development in order to lessen the adverse effects of buildings on the environment.

Green building is one concept to encourage the construction industry to use eco-friendly practices. Through specialised assessments like ecological, social, and economic ones, it can be measured. Kibert (2016) created standards for commercial quality that covered everything from preserving economic value to reducing life cycle costs. The commercial quality of buildings becomes critical in this industry because of the high labour and investment costs. Because of the associated costs and their lack of knowledge about sustainable practices, stakeholders in Indonesia, including developers and owners, were reluctant to incorporate the concept despite its benefits. Caesario (2016) claimed that the cost of green building in the country is 10% to 15% higher than that of traditional construction. The additional cost is

justified by more complex designs, environmentally friendly materials, and state-of-the-art technologies (Zhang et al., 2011; Hwang and Tan, 2012). Silver, gold, and platinum certified buildings in Indonesia were listed by Sertifikasi Bangunan Hijau (2017).

The technical, financial, environmental, and social aspects of green building have all been studied by academics and researchers (Hill and Bowen, 1997; Medineckiene et al., 2015; Shad et al., 2017). However, there was not much evidence to back up the assertion that stakeholders, particularly in Indonesia, understand the principles and practical uses of sustainability and green building certification. As per certain interpretations, sustainability pertains to the way present actions interact, collaborate, and integrate with the preservation of natural resources for the benefit of future generations. In the Brundtland Report of 1987, the United Nations World Commission on Environment and Development (WCED) made reference to the search for a sustainable way to lessen ecological degradation and conserve energy. 1995 saw the start of the conference of parties (COP), which is still going strong today. The annual conferences have produced significant policies to address environmental issues, ranging from the Kyoto Protocol in 1997 to the Paris Agreement in 2015.

In the construction industry, sustainability is seen as a way to preserve the environment. Although the definition of sustainability is dynamic, it is principally grounded in three areas: social, economic, and environmental dimensions (Kibwami and Tutesigensi, 2016). Shi et al. (2013) stated that managing waste, emissions, employing renewable energy, utilising toxic-free materials, and many other aspects are all included in the environment in sustainable construction. These are used to lessen the detrimental effects of human activity and enhance human well-being. Environmental consciousness is also seen by designers as a way to create buildings that could be labelled as eco-friendly. While building owners might wish to generate significant revenue from the building within a specified time frame, building users expect a building that is safe, comfortable, and healthy (Ding, 2008). The gap between the two parties' expectations could be reduced by applying a sustainability concept. Sustainable construction not only lowers operating costs for the building owner but also improves indoor air quality, visual quality, security, and health (Shi et al., 2013; Trencher et al., 2016).

The social aspect of sustainability is influenced by the idea of the human being, the effects of civilization, and the standard and comfort of living (Edum-Fotwe and Price, 2009; Dempsey et al., 2011). Social interaction might be impacted, for instance, by workplace design and

environmental interventions. An open-plan office layout can enhance communication among staff members and let more natural light into the central building since there are fewer walls separating the rooms (Kim and De Dear, 2013). Use of an enclosed footprint plan is appropriate when privacy is paramount. The building envelope, windows, doors, and glazing are examples of passive energy-saving techniques. Developing automated systems is one of the active energy-saving strategies (Sadineni et al., 2011; Henze et al., 2008). The economy of society could be strengthened by social interaction and environmental awareness working together (Pugh, 2014). Tan et al. (2011) gave instances of two phenomena that showed a relationship between prosperity and a conducive environment. Revisionists contended that environmental factors could offer companies a competitive advantage. Porter and Van der Linde (1995) asserted that by being the pioneers in a new market, innovation and new technologies can be used to generate interest and establish a new one. Though this idea is still controversial among practitioners and academics, many believed that the concept of sustainability and its components is the critical success factor in raising a country's competitiveness level. Sustainable construction is associated with environmentally sensitive design (Weingaertner and Moberg, 2014). It intended to limit negative consequences by increasing productivity and utilizing specific materials, energy sources, and spatial configurations. Because the structures built now will affect future expansion, there is an immediate need to raise public understanding of sustainability. It requires the cooperation of pertinent parties during a construction project's planning phase.

The utilisation of renewable energy sources and contemporary, environmentally friendly technology ought to be integrated into the project drafting process. There are several definitions of "green building" found in construction industry literature. Cassidy (2003) defined green building as an endeavour to enhance human settlement over the course of a building's life cycle and to maximise building efficiency through the consideration of natural resources. The International Initiative for a Sustainable Built Environment defines a green building as one that achieves indoor environments, uses less energy and emits fewer greenhouse gases, and has minimal ecological impact. In order to combat climate change, environmental degradation, and the depletion of natural resources, green building is advancement in high-performance building design that primarily considers energy and water usage. This information was reported by the US Environmental Protection Agency in 2016. Robichaud and Anantatmula (2010) defined green building as a strategy to reduce adverse

environmental effects, enhance human well-being, promote economic development, and imply public prosperity. That definition states that the primary goals of green buildings are to safeguard human welfare well into the future and to accommodate the idea of sustainability by combining the value of buildings from an economic and social standpoint with the environment. It is true to say that green buildings might initially cost more than traditional ones. However, there won't be as much need for upkeep and operation, which would eventually offset the original expenses. Green buildings could reduce operating costs by 8–9%, increase building value by more than 7.5%, and increase occupancy rates by 3.5%, claimed Robichaud and Anantatmula (2010).

According to Wen S. and Qiang G. (2022), the massive energy consumption and detrimental environmental effects of the global construction industry have raised awareness of the significance of sustainable building. As a result, creating and designing green buildings is now standard practice in many nations (Hwang and Tan 2012). The objective of green building practices is to maximise the efficient use of resources throughout the life cycle of building projects. Darko et al. (2019) claim that green buildings also improve people's quality of life, reduce environmental pollution, and eventually aid in society's sustainable development. Numerous complex elements, such as high-level sustainability goals, numerous stakeholders, a multitude of uncertain risks, and strict technical evaluation indicators, define green building projects (GBPs) (Zhao et al., 2016; Mok et al., 2018; Bohari et al., 2020). Despite the fact that the relationships among GBP stakeholders have been extensively researched (Doloi 2013; Seuring and Gold 2013; Yang and Shen 2015; Li et al., 2018), resolving issues arising from the complex relationships among stakeholders in construction projects remains difficult (Lin et al., 2019; Yang et al., 2020). This is because in these previous studies, social sustainability and stakeholders were mainly isolated. Such a fragmented approach diminishes the synergistic effect of the complexity of interacting stakeholder concerns (drivers) and has a negative impact on sustainability. Actually, in order to achieve the social sustainability goals associated with green building, more human activities need to be taken into account; stakeholder participation is also more essential to the project's success (Mok et al., 2017).

Studies have shown that the various concerns held by stakeholders and their complex relationships could present a number of obstacles to a project's success. This led to an

increase in the complexity of managing stakeholders (Control et al., 2008; Hwang and Ng 2013; Li et al., 2016; Luo et al., 2017). Moreover, the increasing need for sustainable knowledge and technology made stakeholder management even more challenging (Schröpfer et al., 2017). These challenges affected the attainment of social sustainability objectives. Therefore, it is imperative for project decision-makers to strategize stakeholder participation while considering their diverse concerns and manage this relationship throughout the project. Stakeholder management is widely used in the literature on GBP management; however, the current framework ignores the interdependency between social sustainability and stakeholder concern complexity (Qiang et al., 2021). This is so because stakeholder management provides a methodical way to evaluate sustainability. Social sustainability indicators for GBPs have not yet gained widespread consensus, despite a significant amount of research on sustainability assessment indicators (Chen et al., 2015; Al-Jebouri et al., 2017; Goel et al., 2020).

Social sustainability evaluation indicators, which are effective tools for decision-making that support sustainable development, could be used to assess the degree of social sustainability of GBPs (Zhong and Wu 2015; Chong et al., 2016). For a building to be deemed socially sustainable, it must adhere to a set of rigorous evaluation standards. San Cristóbal et al. (2018) claimed that differences often arise between the ultimate objective and the actual decision-making process because of the complexity of the project. One has access to multiple sustainable assessment indicators and stakeholder concerns. Combining them often causes their complex relationships to change, which exacerbates the decision-making challenges. However, the body of knowledge currently available in stakeholder management is insufficient and unable to provide useful solutions to the aforementioned problems in terms of traditional assessment methodologies and network analysis, the study revealed.

A great deal of the literature that has just been published has looked at social sustainability. However, there is still no consensus regarding the social sustainability indicators of green buildings (Goel et al., 2020). Key sustainability indicators must be identified in order to assess the social sustainability of green buildings over the course of their lives. In reality, GBPs are complex when it comes to sustainable technology. It is also very difficult to identify all of the stakeholder concerns throughout the project life cycle because of their sheer number. Measuring social sustainability is difficult, and there are few studies on the subject. Unlike previous studies by Mok et al., (2018); Goel et al., (2020); Yadegaridehkordi et al.,

(2020); Zhang and Mohandes (2020) on social sustainability indicators and stakeholder concerns, the results of this study emphasised the capacity to identify critical concerns and recognise patterns of propagation through sustainability paths, which in turn improves the efficacy of a project's sustainability management. An examination of the literature on the interdependency modelling of social sustainability in GBPs and stakeholder concerns reveals that the complex nature of stakeholder concerns may hinder decision-making, thereby affecting the sustainability level of GBPs (Zhang and Mohandes, 2020).

2.3. The role of stakeholder perspectives in the adoption of innovative sustainable construction

The depletion of natural resources makes sustainability a global concern. When making decisions about building materials, the three pillars of ecological, economic, and social wellness are also referred to as sustainability (Mashwama et al. 2020). Sustainability aimed to prevent environmental degradation caused by infrastructure development, preserve natural resources, and use energy and water resources efficiently (Mashwama1 et al. 2020). It is impossible to achieve sustainable development without the building industry. But stakeholders in building projects frequently don't know exactly what their roles and responsibilities are. These stakeholders include a wide range of organisations from the construction industry, such as homeowners' associations, architects, developers, contractors, and local government agencies. Strong stakeholder cooperation is necessary to achieve the goals of sustainable housing, and effective stakeholder management is crucial to the success of complex projects. According to Leo-Olagbaye, Odeyinka, and Stakeholders (2023), sustainable housing is defined as creating buildings with an eye towards the environment and resources while integrating sustainable practices into the building's overall architecture.

Major stakeholders need to be fully informed about the process and actively involved in order to achieve sustainable housing. Stakeholders are groups of people, organisations, or alliances that could be impacted by or have influence over choices, actions, or results pertaining to a project. The importance of stakeholders in the implementation of sustainable housing projects has been established by earlier research. It is possible to categorise these stakeholders into internal and external groups. In addition to supply-side experts like architects, structural

engineers, quantity surveyors, main contractors, and suppliers, demand-side players like clients, financiers, client representatives, and end users are also considered internal stakeholders. External stakeholders include, for example, the local community, environmentalists, conservationists, and archaeologists, as well as private actors like the government and regulatory agencies. The roles and competencies of stakeholders determine their level of influence in a project. Therefore, in order for stakeholders to fulfil their obligations and contribute to the project's success, they must be completely aware of their roles (Berawi et al., 2019)

Many factors could be used to assess a project's performance, such as the number of sustainable housing projects finished, stakeholder satisfaction, energy efficiency in building projects, the frequency of structural defect rework, timely project management, and budgetary compliance. By encouraging social cohesion, improving economic efficiency, and consuming less energy and resources, sustainable housing development seeks to lessen its detrimental effects on the environment (Odeyinka, Rathnasiri, and Stakeholders, 2023). The construction industry is a fragmented sector due to the involvement of multiple stakeholders. It is challenging to carry out the SC agenda because of the disjointed and intricate communications among the numerous stakeholders, each of whom has different objectives.

Authorities such as National and local governments can assist in coordinating the activities of the construction industry by enacting laws, rules, and incentives. In addition, governments are the main global clientele of the construction sector. Nearly all efforts made since the start of the sustainability programme have either been government-initiated or centred around them. This is demonstrated by the fact that a number of relevant sustainability studies conducted in the developed world credit a government initiative for the modification phenomenon under study. Government involvement in addressing the core problems and forces that shape the industry is a more effective way to bring about long-term change. A number of roles are played by government regulatory bodies in the implementation of sustainable housing projects. These include establishing and supervising sustainability initiatives during the construction phase, enacting pertinent legislation in support of sustainable construction, establishing guidelines in support of sustainable construction, offering and enforcing the required incentives for sustainable compliance, and financing sustainability education, research, and development to raise public awareness of the value. The report also outlined the duties of government agencies in terms of planning with sustainability goals in mind,

assessing design choices in light of sustainability assessment techniques, overseeing project execution to ensure compliance with sustainability standards, securing the necessary licenses to support sustainable building, and developing and assessing procurement plans and alternatives that are suitable for sustainable building. However, according to Odeyinka, Rathnasiri, Leo-Olagbaye, and Stakeholders (2023), some government roles were not fully understood by government agencies. Since government regulatory bodies establish standards, guidelines, and regulations for construction practices, they are essential in guaranteeing the availability of sustainable housing. They support sustainable housing initiatives with incentives and policies, encourage green building certifications, and enforce adherence to sustainability codes. Monitoring and evaluating the environmental impacts of housing projects is another duty of government agencies.

According to Oyewole, Komolafe & Gbadegesin (2023), the primary force behind the creation of SC practices is the development community. This approval could theoretically be problematic because some research suggested that developers' lack of knowledge about SC is a barrier. This begs the questions of whether developers care enough to make a difference or are aware of SC enough to request it. To create sustainable housing projects, developers need to be motivated by sustainable construction; they need to bring forward sustainable ideas during the briefing phase; they need to stay current on sustainable building principles; they need to arrange funding and negotiate funding terms with other stakeholders; they need to hire qualified professionals with experience in sustainable construction; and they need to pay attention, according to the author's outline of responsibilities.

Architects play a critical role in providing sustainable housing because they integrate environmentally friendly design principles and practices into their projects. It is their duty to incorporate sustainable materials, passive design ideas, and energy-efficient systems into the building's architecture. To make sure the project satisfies certification requirements and sustainability standards, architects work in conjunction with other interested parties (Wen and Qiang, 2022).

For sustainable housing projects to be completed successfully, project managers are essential to the entire construction process. They are in charge of organising and combining the efforts of different parties involved, such as contractors, engineers, and architects. In addition, project managers oversee the execution of sustainable plans, keep an eye on project

schedules, and handle any issues that might come up in relation to sustainability. When structural engineers design sturdy, efficient structures with low material and resource consumption, sustainable housing projects advance. To improve the project's sustainability, they take into account things like creative structural designs, efficient material usage, and sustainable construction methods. Another essential element that guarantees the robustness and safety of sustainable buildings is structural engineering (Zainab et al., 2013).

Electrical engineers design energy-efficient electrical systems, which help to provide sustainable housing. To minimize energy consumption and its impact on the environment, they prioritize optimizing the electrical infrastructure, incorporating renewable energy sources, and putting energy-saving technologies into practice. Intelligent and sustainable building automation systems are also developed by electrical engineers (Zainab et al., 2013).

Value engineering and cost management services are offered by quantity surveyors to aid in the delivery of sustainable housing. They evaluate the financial sustainability of sustainable initiatives and help identify ways to adopt sustainable behaviours at a reasonable cost. Quantity surveyors are also involved in the life-cycle assessment of sustainable building materials and technologies (Zainab et al., 2013).

Banville et al. (1998) defined a stakeholder as any individual or group of individuals having a stake in a problem that could influence, be affected by, or have an impact on the problem. Freeman (1984) defined a stakeholder as an individual or group of individuals who can affect or have an influence on an organization's goals. A novel theory and strategy classification model of stakeholder sustainability was presented by Mainardes et al. (2012). It comprises six categories of stakeholders: regulators, controllers, partners, passive, dependent, and non-stakeholders. This model bears similarities to that created by Roloff (2008), who divided stakeholders into categories such as political actors, workers, customers, and social and environmental issues.

Mechanical engineers create energy-efficient HVAC (heating, ventilation, and air conditioning) systems that support sustainable housing projects. Their main objectives are to increase indoor air quality, optimise energy efficiency, and use renewable energy sources for both heating and cooling. In addition, water-efficient plumbing systems and sustainable water management strategies must be promoted by mechanical engineers (Eunsup, 2014).

In order to realise sustainable design concepts, builders are required. In line with sustainable building practices, they are in charge of finishing construction projects, making sure waste is appropriately managed, and installing energy-efficient systems. It is the responsibility of builders to use environmentally friendly construction methods and sustainable building materials, according to Eunsup (2014).

Zainab S, Pan W, Goodhew S, and Fuertes A (2013), Freeman's (1984) suggested model that takes into account a wider range of stakeholders than just the conventional ones, such as customers, shareholders, staff members, suppliers, and rival companies. The impractical challenge of managing all stakeholders at once is presented by this. However, this issue can be resolved by using stakeholder prioritisation criteria that concentrate on a select few significant groups (Macharis et al. 2012). As such, it is imperative to conduct an initial assessment of the interested parties and the associated issues they have (Mainerdes et al., 2012). It is therefore essential to ascertain the interests of the stakeholders. This could be achieved by examining their requirements and limitations, which will enable the discovery of a workable and acceptable solution to satisfy the demands of the parties involved (Macharis et al. 2012). A policy or program's stakeholders were identified through the systematic collection and evaluation of qualitative data (Chinyo et al 2010, Mainardes 2012, and Macharis 2012). This process helps identify which parties' interests should be considered during the policy's development and/or rollout. Stakeholder needs can provide information about issues, concerns, and requirements for the projects. Chinyo et al. (2010) stated that the stakeholder circle methodology can be used to identify important stakeholders and create an engagement strategy and communication plan that would meet their needs and goals.. Numerous studies have recognised the significance of stakeholder management (Newcombe 2003, Macharis 2012, and Brucker et al. 2013). Because construction projects are complex, unpredictable, and involve many parties, the construction industry has a poor history of managing its stakeholders. This is the result of unclear goals, inadequate involvement, and poor stakeholder communication, according to Loosemore (2006). Handling stakeholders in construction projects in Hong Kong is essential to their success. Yang and colleagues (2009) examined this. Professionals in the construction industry validated and ranked the study's list of 15 essential success factors. The top three factors were managing stakeholders' social responsibilities (economic, legal, environmental, and ethical), assessing the needs and limitations of stakeholders in relation to the project, and effectively and consistently

interacting with stakeholders. The study can be used as a tool in stakeholder management assessments to establish the highest priority elements.

The main goal of choosing suitable sustainable technologies to lower energy and carbon emissions and create sustainable retail buildings is shared by a wide range of stakeholders. This multi-criteria decision problem is complicated because it involves many different stakeholders, including clients, subject matter experts, and end users, and there are a lot of viable options. As a result, the adoption of sustainable technologies is slowed down. Furthermore, the selection process currently employs knowledge-based techniques in the lack of formal available measurement criteria or strategies (Wang et al. 2009, Catalina et al. 2011). According to Akadiri et al. (2013), these methods did not address the needs of stakeholders because they did not prioritise and give weight to pertinent selection criteria. As a result, it is critical to establish a systematic selection process that identifies and ranks pertinent criteria in accordance with stakeholder requirements (Catalina 2011) and to have a complete awareness of each stakeholder's objectives (Macharis et al., 2012).

According to Mashwama et al. (2019), a sustainable practice (SC) is completing construction projects within budget and protecting the environment, including the social welfare of the occupants. Azis et al. (2012) believed that social stability (SC) necessitates a dedication to economic stability, which entails the efficient use of labour, materials, energy, water, and resources, environmental stability, which entails using resources while protecting the environment, and social stability, which ensures that residents receive satisfactory results. For example, the idea that SC can meet current demands without depleting resources for future generations is contested by Al-Sanad (2015); Aigbavboa et al., (2020).

According to Leo-Olagbaye, Odeyinka, and Rathnasiri (2023), the construction sector is necessary to achieve sustainable development. However, stakeholders in construction projects often lack clarity regarding their respective roles and responsibilities. A variety of organisations from the construction sector, including local government agencies, architects, developers, contractors, and homeowners' associations, are among these stakeholders. Effective stakeholder management is essential to the success of complex projects, and strong stakeholder cooperation is required to meet the goals of sustainable housing. Sustainable housing is defined as designing structures that are resource and environmentally-conscious while incorporating sustainable practices into the overall architecture of the building. To

achieve sustainable housing, major stakeholders must be actively involved in the process and fully informed about it. Stakeholders are individuals, groups, or organisations that may be affected by or have a say in the decisions, actions, or outcomes of a project. Previous research has demonstrated the significance of stakeholders in the execution of sustainable housing projects. According to Blind and Heß (2023), these stakeholders can be divided into groups that are internal and external. Internal stakeholders also include demand-side participants such as clients, financiers, client representatives, and end users, in addition to supply-side specialists such as architects, structural engineers, quantity surveyors, main contractors, and suppliers. Public entities like the government and regulatory bodies, as well as private actors like the locals, environmentalists, conservationists, and archaeologists, are examples of external stakeholders. Stakeholders' influence in a project depends on their roles and competencies. Therefore, stakeholders must be fully aware of their roles in order to fulfil their responsibilities and help the project succeed. A project's performance can be evaluated using a wide range of criteria, including the quantity of sustainable housing projects completed, stakeholder satisfaction, energy efficiency in construction projects, the frequency of rework for structural defects, timeliness in project management, and budgetary compliance. Oguntona et al. (2019) added that sustainable housing development (SHD) aims to reduce negative environmental effects by promoting social cohesion, enhancing economic efficiency, and reducing resource and energy consumption. A fragmented sector is the primary way to describe the construction industry because it involves a lot of different stakeholders. The fragmented and complex communications amongst the various stakeholders, each of whom has distinct goals, make it difficult to implement the SC agenda.

According to Goh, Rowlinson, & Yip (2013), by enacting rules, regulations, and incentives, national and local governments could help to coordinate the activities of the construction industry. Moreover, governments are the primary clientele of the construction industry worldwide. Since the inception of the sustainability programme, almost all efforts have been either government-initiated or focused on them. This is exemplified by the fact that several pertinent sustainability studies carried out in the developed world attribute the modification phenomenon under investigation to a government initiative. To achieve long-term change, government engagement in addressing the sector's fundamental issues and driving forces is a more effective strategy.

Government regulatory agencies play a number of roles in achieving sustainable housing projects, according to Blind and Heß (2023). These include formulating relevant legislation that promote sustainable construction, providing guidelines for sustainable construction, providing and executing the necessary incentives for sustainable compliance, initiating and overseeing sustainability initiatives during the construction phase, and funding sustainability education, research, and development to increase public awareness of the benefits of sustainable construction. In addition, the report delineated the responsibilities of government agencies with regard to designing with sustainability objectives in mind, evaluating design decisions in light of sustainability assessment methodologies, monitoring project implementation to guarantee adherence to sustainability standards, obtaining the required permits to facilitate sustainable building, and formulating and evaluating procurement strategies and options that are appropriate for sustainable building. On the other hand, government agencies are often unaware of certain government roles. According to the report , these responsibilities include drafting and assessing contract terms for their suitability in light of sustainable construction, outlining available dispute resolution processes for sustainable construction, upholding standards for ethical sourcing for sustainable construction, informing stakeholders about sustainable construction material options, monitoring advancements in sustainability and ethical supply chains, and collaborating with stakeholders to increase public awareness.

The developer community is the primary stakeholder in the establishment of SC practices. This approval poses a theoretical problem because some research suggests that a developer's ignorance of SC could be preventing SC. Because of this, there are questions about whether developers are aware of SC enough to ask for it or whether they care enough to make a difference. The study claims that developers contribute in a variety of ways to the accomplishment of sustainable housing projects. These responsibilities include being interested in sustainable construction, contributing sustainable ideas during the briefing stage, remaining current with sustainable building knowledge, obtaining funding and negotiating terms of agreement with other stakeholders, employing experienced professionals with a track record in sustainable construction, and heeding astute professional guidance that advances sustainable construction (Blind and Heß (2023); Oyewole, Komolafe & Gbadegesin (2023).

Enayat et al. (2020) believed that in order to provide sustainable housing, architects are crucial because they incorporate eco-friendly design principles and practices into their projects. It is their duty to design the building with energy-efficient systems, passive design principles, and sustainable materials. Architects collaborate with other interested parties to ensure that the project meets sustainability standards and certification requirements. Sustainable design entails keeping a floor to green ratio, producing zero greenhouse gas emissions, precisely defining sustainable features, characteristics, materials, and methods, evaluating pricing decisions in light of the project's objectives, and outlining the information that sustainable stakeholders must supply. The research also delineated the functions of developers, encompassing the assessment of design experts' sustainability qualifications, the identification and allocation of risks associated with sustainable constructions, the development of end-user occupancy guides, the creation of sustainable post-construction maintenance plans, the evaluation of client fund acquisition decisions and the provision of suitable counsel regarding the benefits of sustainable projects, the facilitation of stakeholder engagement concerning general and sustainability issues, and the observance of ethical sourcing guidelines for sustainable construction materials, the report said.

Delivering sustainable housing is aided by the value engineering and cost management services provided by quantity surveyors. They assess the economic feasibility of sustainable projects and help find ways to adopt sustainable behaviours at reasonable prices. Quantity surveyors also participate in the evaluation of the life-cycle costs associated with sustainable building materials and technologies. Sustainable housing projects are advanced when structural engineers create strong, effective structures with minimal material and resource consumption. They also consider things like innovative structural designs, effective material usage, and sustainable construction techniques to increase the project's sustainability David Hickey and Jason Hickey (2021). Structural engineering is another crucial component that ensures the durability and security of sustainable buildings.

Project managers are critical to the entire construction process and are necessary for the successful completion of sustainable housing projects. They oversee the coordination and integration of the various stakeholders' efforts, including architects, engineers, and contractors. Project managers also help to implement sustainable strategies, keep an eye on project schedules, and handle any problems that may arise in connection with sustainability (Bal 2013).

Electrical engineers provide sustainable housing through designing energy-efficient electrical systems. Using energy-saving technologies, optimising the electrical infrastructure, and integrating renewable energy sources are their main areas of focus in order to reduce energy consumption and its environmental impact. One more responsibility for electrical engineers is to create environmentally responsible and intelligent building automation systems, Bal (2013) revealed.

.

Builders are necessary to bring sustainable design concepts to life. They are responsible for completing construction tasks, ensuring waste is properly managed, and installing energy-efficient systems in accordance with sustainable building practices. The use of sustainable building materials and environmentally friendly construction techniques are the duties of builders, according to BAL (2013).

.

According to Zainab, Pan, Goodhew, and Fuertes (2013), a "stakeholder" is any person or group of people with a stake in an issue that has the potential to influence, be affected by, or have an impact on the issue. According to Freeman (1984), a stakeholder is a person or group of people who have the power to influence an organization's goals or to be affected by them. Mainardes et al. (2012) proposed a new model of stakeholder sustainability - theory and strategy classification with six types of stakeholders (regulator, controller, partner, passive, dependent, and non-stakeholder). This model bears similarities to that developed by Roloff (2008), who categorised stakeholders into groups comprising social and environmental issues, workers, customers, political actors, and regulators, among others. Freeman's (1984) proposed model includes stakeholders other than the traditional ones, such as suppliers, competitors, employees, shareholders, and clients. This presents the impractical challenge of managing all stakeholders simultaneously. Stakeholder prioritisation criteria, however, could address this problem by focusing on a small number of important groups (Macharis et al. 2012). Consequently, it is essential to perform a preliminary examination of the stakeholders and their corresponding concerns (Mainerdes et al., 2012).

A multitude of stakeholders shared the overarching objective of selecting appropriate sustainable technologies to reduce energy and carbon emissions and develop sustainable retail buildings. The complexity of this multi-criteria decision problem is attributed to the abundance of options, feasible solutions, and a wide range of stakeholders, including clients, subject matter experts, and end users. This slows down the adoption of sustainable

technologies. Furthermore, in the absence of formal available measurement criteria or strategies, the selection process currently uses knowledge-based techniques (Wang et al. 2009, Catalina et al. 2011). These techniques, in the opinion of Akadiri et al. (2013), fall short of meeting stakeholder needs by failing to provide solutions that prioritise and assign weights to relevant selection criteria. Consequently, it is imperative to have a thorough understanding of each stakeholder's objectives (Macharis et al., 2012) and to implement a systematic selection process that finds and prioritises relevant criteria based on stakeholder requirements (Catalina 2011). Stakeholder engagement and sentiment monitoring can assist in identifying and prioritising environmental and social issues that require attention and in developing solutions that satisfy those concerns. Stakeholders could also be a strong force for change inside an organisation. They could inspire others to join the effort and aid in bringing sustainability issues to the public's attention. The long-term success of this strategy would be supported by making sure that everyone has a voice and that ESG agenda represents the priorities of those who matter.

A company could benefit from sustainability in a variety of ways: directly by using less energy, indirectly through the branding of the employer, or even unintentionally through client retention and reputation. However, by definition, sustainability is primarily a way to add value for society. The stakeholders of a company represent society in a business setting. Stakeholders are therefore crucial in determining a company's direction and course of action. Nevertheless, companies continue to underestimate the influence of stakeholders, even though they can direct a company's sustainability. To address this, it is necessary to constantly advise the clients to include their stakeholders in the process of creating a sustainability plan or roadmap. When the definition of corporate social responsibility (CSR) is examined, the place of stakeholders in a business ecosystem becomes evident. CSR is the term used to describe a company's accountability for the social effects of its commercial operations. A wide range of stakeholders are impacted by these effects, which can be ethical, environmental, or social. Corporate Social Responsibility (CSR) encourages businesses to incorporate social and environmental concerns into their business operations and stakeholder interactions. Through it, a business balances the demands of the economy, the environment, and society, all the while meeting the expectations of stakeholders and shareholders, Eunsup Daniel Shim (2014).

Leading frameworks viewed stakeholder engagement as a basic practice, including the GRI

Standards and the ISO 26000 guidelines for social responsibility. Stakeholder engagement is one of the two core practices of social responsibility (ISO) in the schematic overview of ISO 26000 that follows. Stakeholder engagement is essential in discussing sustainability. Companies could meet the expectations of stakeholders and generate benefits for them by engaging with them. It also enables businesses to get ready for change. Stakeholder engagement reveals the key areas that need to be addressed and provides insight into a company's innovation agenda. It can enhance the business offering by optimising the stakeholder experience. For stakeholders, the effects of business operations may cause problems. Eliminating these problems improves a product or service's overall quality. Stakeholders have a stake in the business's operations and how they affect society and the environment. These people include the local community, investors, customers, suppliers, and employees. When a company adopts more sustainable practices, it may be motivated by their concerns and interests. For example, there is a growing consumer demand for environmentally friendly goods and services. Companies may be compelled by consumer pressure to employ sustainable materials, lower their carbon footprint, and develop waste management techniques (Zainab et al. 2013).

Another important stakeholder group that has the power to affect a company's sustainability practices is its suppliers. They might decide to exclusively work with businesses who share their commitment to sustainability, or they might provide incentives to adopt sustainable practices, like price breaks for purchasing sustainable materials in bulk. Businesses may be inspired to integrate sustainability into their supply chain management as a result (Leo-Olagbaye, Odeyinka, and Rathnasiri (2023).

As a stakeholder, the local community could also have a big impact. Businesses that operate in a way that impairs the community or the environment might encounter opposition, which could hurt their brand and financial results. This opposition could take the form of protests or legal action. Businesses might embrace more sustainable practices in order to preserve good relations with the community. To sum up, a company's sustainability practices could be greatly influenced by the interests of its stakeholders. Companies could improve their sustainability performance and reap a number of benefits, such as better financial performance, increased customer loyalty, and improved reputation, by attending to the needs and concerns of different stakeholder groups (Oyewole, Komolafe & Gbadegesin 2023).

According to Eunsup (2014), a paradigm shift entails adding value, treating staff members and clients with dignity, showing respect for your suppliers, and ultimately generating profits for the shareholders (Latham, Stone; Bloomberg Business Week, 2013). An even stronger current economic recovery, in which the pressure on community service, local business stress, and high unemployment have all been largely offset by rising earnings. Current corporate theories argued in favour of the stakeholder perspective and placed more emphasis on long-term sustainability than on maximising profits and the interests of shareholders. According to the stakeholder perspective, a corporation exists for the benefit of its stakeholders, which include customers, suppliers, employees, and, to some extent, the general public. This is in addition to the shareholders' benefit. It moves away from shareholder-focused single-objective optimisation and towards multiple-objective stakeholder optimisation.

According to Friedman (1970, 1962), "the social responsibility of business is to increase its profits." Managers have fiduciary obligations and profits exclusively to shareholders. The fundamental idea behind the shareholder theory is that higher profits translate into higher taxes and more opportunities for contributions to the general good. The government should handle the equitable distribution of wealth, not the business entity, according to the shareholder maximisation theory, which called for a division of labour between the two. This point of view rejected the moral obligation of corporations to promote the "common good."

Also, Freeman (1983, 2010) indicated that a company must act in the best interests of all of its stakeholders, including its shareholders. The manager should be concerned with all value chain partners and act in the best interests of all stakeholders, including customers, creditors, employees, and shareholders. For instance, a manufacturer needs to source high-quality parts if it hopes to create a product of the highest calibre. The manufacturer is unable to produce high-quality final products unless part suppliers supply these high-quality parts. The manufacturer should consider the quality of parts supplied in addition to minimising the cost of parts from suppliers. According to Freeman et al. (2004), maximising stakeholder value is a pro-shareholder objective and the stakeholder theory is consistent with shareholder theory. Stakeholder theory helps companies better understand the risks and management of entrepreneurship. Businesses should care about food safety, the environment, and the welfare of future generations in addition to just making a profit.

Businesses select strategies to accomplish their objectives and gain a competitive edge. A more comprehensive perspective on long-term corporate management is offered by the stakeholder theory. Managers should maximise stakeholders' interests, according to the corporate board. In addition to short-term profits, the Board should push managers to pursue sustainability over the long term. Long-term sustainability objectives should be part of corporate strategy, in addition to the share price target. Product and service differentiation, market segmentation, and cost leadership are common corporate strategies. Companies should focus on strategies relating to stable employment, a stable customer base, corporate reputations, and corporate social responsibility in order to pursue long-term sustainability (Mashwama et al 2020).

Mashwama et al (2020) made it clear that making ethical decisions may play a significant role in corporate strategy. Ethics and business don't have to be mutually exclusive. Making ethical business decisions enhances a company's reputation, encourages sales, and ultimately boosts profits. Sustainability is more important in the long term than profitability. Partners in the supply chain have a direct impact on sustainability and long-term profitability. Increased sales, lower operating costs, and fewer business risks are all a result of improved employee and customer loyalty. Stakeholder theory offers a better perspective on corporate management and is directly related to long-term sustainability and profitability. Companies that adopt a stakeholder perspective have the potential to "do well by doing good" over time. Businesses with a narrow focus on short-term profits might make decisions that would ultimately affect their ability to survive in the long run. For instance, managers might not be investing enough, might not wish to support social and civic organisations, and might be producing potentially harmful products in order to increase short-term profits. By empowering business decisions, the stakeholder theory promotes the just and equitable distribution of corporate profits. The stakeholder perspective appears to offer a better way to manage corporations in the new and modern economy by encouraging long-term, moral decision-making and showing concern for the common good, all of which will eventually contribute to increased profitability, shareholder wealth, and long-term sustainability.

According to Bal et al. (2013), there might be a large number of stakeholders involved in a construction project, depending on its size, but most of the time there are only a few important stakeholders who are highly salient in terms of sustainability. In addition to the target group and the implementing society, stakeholders can also include any individuals,

groups, or communities involved in a project. The Design Engineer claimed that stakeholders have the right to recognise all of these parties, anticipate their reactions, and gain and maintain support—or opposition—for the project plan, if it is controversial. It would be simpler to identify these stakeholders if the project's goal and the planning process as a whole are clear. Under such conditions, it is feasible to pinpoint those crucial individuals. It is also important to remember that various stakeholder types are involved in different phases of a construction project, including pre-design, design, bidding, and construction.

One important step in defining the parties to be involved and the parties not to be involved is the formal identification process. As with other success criteria, stakeholders could be identified with reference to a project's sustainability mission based on their power, interest, and attitude, all of which are related to their potential impact on the mission's accomplishment. The study went on to say that it's critical to link stakeholders to various sustainability-related targets following the stakeholder identification phase. The sustainability consultant claimed that various stakeholders have varying levels of working knowledge and abilities. As a result, they contribute differently to achieving sustainability-related results. People have different relationships with the project as a result of these disparate skills and knowledge. Make sure that the project's important stakeholders are aware of its goals and its commitment to sustainable development. The project's goals must align with the responsibilities and abilities of its "stakeholders" and must continue to serve their interests as the project develops, the environment shifts, and the interdependencies of important systems, stakeholders, and their goals shift. Stakeholders are involved in creating a sustainability strategy that maximises project benefits by taking into account all sustainability-related factors. Stakeholders are ranked according to their authority and power; the higher a stakeholder group is on the priority list, the more efforts are made to involve that group. Prioritising stakeholders could be done using the following criteria: those with the greatest decision-making authority; those who directly impact the project's economy, society, or environment; and those who are unaffiliated with the project but still want to see it result in a sustainable solution (Jackson 2021).

According to Li et al. (2018), diverse stakeholders with varying social, environmental, and economic interests are impacted by sustainable construction projects. To prevent project failures, decision makers must maintain effective communication with pertinent groups. While citizen participation can help better address and meet stakeholder expectations and

concerns, decision-making processes for modern sustainable projects are getting more and more complex as more stakeholders actively defend their own interests. According to the study, the government is the most powerful organisation, and determining how much it must intervene to balance the interests of various stakeholders is a significant problem. The significant potential impact of end users is also noted, indicating the necessity of a more open and inclusive participatory process for decision-making and evaluation in the nation.

Global interest in the idea of sustainability is growing, and it encompasses the three main pillars of social consciousness, environmental responsibility, and financial viability (Pitt et al., 2009). In order to meet the needs of the present without compromising those of the future, sustainable development seeks to strike the correct balance between these factors (WCED, 1987). According to Dickie and Howard (2000), sustainable construction is the architecture, engineering, and construction (AEC) sector's contribution to sustainable development. Thus, different stakeholders with varying social, environmental, and economic interests are impacted by sustainable projects. To prevent project failures, decision makers must thus maintain effective communication with pertinent groups (Ng et al., 2012). To better address and meet the expectations and concerns of the relevant groups (i.e., stakeholders), Li et al. (2012) recommended involving them at every stage of the project lifecycle. This aligns, in part, with the constituency-building approach put forth by Hillman and Hitt (1999) to impact public policy through a bottom-up approach. Conversely, the government might be reluctant to involve stakeholder groups because it fears that an overly engaged populace could spark social unrest and conflict (Shan and Yai, 2011). Regarding modern sustainable projects, practitioners are also concerned about the decision-making and assessment process, which is growing more difficult for this kind of scheme (green buildings) as a result of stakeholders' increased desire to actively participate in protecting their own interests. For example, in China, the green concept has gained importance recently, but there are still obstacles preventing its widespread adoption in the AEC sector, with the decision-making and evaluation procedures currently in place being frequently criticised for their lack of legitimacy and acceptability (Ding, 2015). Comparing modern sustainable projects to more traditional ones, Li et al. (2012b) assert that more stakeholders are willing to engage in the more complex interactions that occur within and between stakeholder groups during the project's lifetime (that may not emphasise the overall economic, social and environmental benefits involved). For the project to go smoothly, the project initiator(s) must weigh the interests of several pertinent groups.

2.3.1. Leveraging economic incentives to promote the implementation of sustainable development in the construction industry

Understanding how incentives affect a company's operations, personnel, structural costs, tax liabilities, and financial statements, as well as utilizing new technology and data analytics to uncover the greatest possibilities, can help an organization reduce operating expenses and increase net income (Matheny, 2023). By comprehending the regional business climate, tax environment, and agendas of various economic development organizations, incentives experts improve success for customers.

Sustainability is defined as the development which "meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (Nguyen & Ye, 2015:390). The construction industry needs to evaluate its success or achievement in the long term, looking at the internal and external constraints influencing its performance (Aladag & Isik 2016:11), and this is achieved through applying performance measures. Sibiya et al. (2015:3) define performance measurement as the process of quantifying the efficiency and effectiveness of actions. Considering that construction projects are unique and possess different objectives, determining performance measures and their correlation to company performance is needed. These measures help companies to evaluate their long term success, taking into consideration the internal and external factors affecting their performances (Aladag & Isik, 2016:11). Also, performance measurement assists companies to develop strategic direction and improve their competitiveness within the industry (Ali et al., 2013:126). This is done through “regular collecting and reporting of information about inputs, efficiency and effectiveness of process or projects” (Sabone & Addo-Tenkorang, 2016:1493). To achieve construction industry sustainability, a set of performance measures balancing financial and non-financial (operational) performance should be an integral part of any company (Ali et al., 2013:130). Generally, only financial performance measures were traditionally used to evaluate the performance of the construction industry (Ali et al., 2013:125; Horta et al., 2012; Hu & Liu, 2016). More recently, profitability, sales growth, financial stability, and cash flow are the highly ranked financial measures, with profitability found to be the most used and valued measure in many studies (Aladag & Isik 2016:11; Ali et al., 2013:132; Bassioni et al., 2004:48; Costa et al., 2004:11; Hu & Liu, 2016:156; Jung et al., 2018:12; Prasad et al., 2018:18). To the authors’ knowledge, these measures are indications of improvements or regressions achieved from the leading indicators such as quality, and

productivity of workers. They also help executives of companies to identify specific gaps and actions within the business, allocate them to employees and evaluate employees on the execution of those actions (Ali et al., 2013:130). Profitability refers to the company's ability to generate profit within a given operating period (Prasad et al., 2018). Oladimeji and Aina (2018:123) indicated that financial performance alone does not determine the company's well-being, instead, it should be partnered with a good organisational culture and employee attributes. Factors such as an increase in the industry's competitiveness rise in construction costs (including labour costs) and low labour productivity seriously affect the company's profitability (Chan & Martek, 2017:145). These factors have led to major criticism of these financial measures, most notably, of "lagging indicators, inadequacy, narrow, and reactive" (Ali et al., 2013; Bassioni et al., 2004; Isik & Aladag, 2016), and their inability to reflect current value-creating actions which could result in unexpected losses to investors (Jung et al., 2018:1).

According to Willis and Rankin (2011:20), financial measures indicate the results of management actions already taken which is the major problem for the construction industry. Although criticism has continued to rise, Thompson et al. (2017) argue that efficient management of these measures provides the company with a competitive advantage when compared to its rivals. With traditional financial measures no longer sufficient to be solely used for measuring construction performance, non-financial measures, such as timely completion of a project, client relations, customer and client satisfaction, and employee productivity, could be used together with the financial performance measures (Ali et al., 2013:130; Tripathi & Jha, 2018:1063). According to Ali et al. (2013:130), these measures are heavily influenced by quality of service and work rendered to customers. Measuring the performance of Guyana's construction industry, Willis and Rankin (2011:20) examined the non-financial measures that are perceived to have a cause and influence relationship with the lagging measures. The authors further found that these measures provide early warnings, which enable companies to provide or seek solutions that will bring advantage to the affected lagging results. Like Ali et al. (2013), they indicated that these measures are leading indicators, meaning they allow managers of the companies to realise potential financial performance contraction before it emerges. Hence, Tripathi and Jha (2018:1052) examined that it is crucial for construction companies to familiarise themselves with critical performance measures to evaluate their performance at both the project and organisational level.

Sustainable construction denotes “the contribution of the construction sector to economic prosperity, social well-being, and environmental sustainability” Ye et al. (2015:3), Performance is defined as the ability to continually improve the company’s efficiency or productivity to remain sustainable and competitive in the market (Horta et al., 2012 and Hu & Liu, 2016). Therefore, from the above concepts, the sustainability performance of the construction industry denotes the comprehensive degree to which the construction industry supports sustainable development. Generally, projects develop goals and objectives to be pursued in order to provide specific benefits for society (Mavi & Standing, 2018:752). To the author’s knowledge, the success of the project is measured in terms of its constraints such as time, cost, and quality. To achieve these constraints; a clearly defined scope of work and effective site management during execution (Gunduz & Yahya, 2018:76), and effective human resource management (Ranawat et al., 2018), is required. Like IŞIk and AladaĞ (2016:506) indicated, a company’s performance is determined by the success of the projects it executes which results in the overall performance of the construction industry. Some researchers preferred to investigate critical success factors or causes of failure in the construction industry. Critical success factors are measures for evaluating project success which result in the sustainable performance of the construction industry. These CSFs can either be quantitative or qualitative (Sfakianaki, 15 2019:176), and this makes it challenging to measure observations of current trends (Mavi & Standing, 2018:761). To achieve success in the construction industry, several underlying factors which influence the performance should be considered. This provides an opportunity for construction managers to have a proper allocation of resources addressing these factors. For better performance sustainability in the construction industry, a diversity of factors from various categories is important (Sfakianaki, 2019:189). For discovering the most factors influencing sustainable performance in the construction industry, a literature review was conducted which led to articles covering various countries globally.

Although Lindhard and Larsen (2016:668) postulated that different project participants’ experienced these factors differently, most of the studies reviewed showed several similarities and those most common were chosen and grouped into 15 groups: scope definition, political and policy formulation, technical capacity, knowledge management, material management, quality, resource capacity, technology transformation, regulatory, job satisfaction, business conditions, leadership, budget constraints, corruption, and socio-cultural factors. Bjørn et al. (2018:75) define scope definition as one of the phases (initiation phase) within the project

which “determines what product systems are to be assessed and how this assessment should be placed”. Defining project scope involves collaboration of appropriate or relevant stakeholders concerned right at the beginning of the project planning (Chaturvedi et al., 2018:347), and this affords each stakeholder an opportunity to clearly define what need to be done, and the expectations of the deliverables from each party involved (Gunduz & Yahya, 2015:76). Having a well-defined scope of work provides a clear vision and goal of the project, as each party involved becomes fully aware of what is expected from them (Gunduz & Yahya, 2018:76). .According to Tayeh et al. (2018:307), executing a project without understanding its objectives is an ingredient of project failure. According to the authors’ finding, the main reason for poor scope definition is attributed to insufficient time given to designers to prepare designs and project drawings. A clearly defined and well-resourced scope of work minimises variations to orders and disputes during execution which result in major delays or an increase in project costs (Gunduz & Yahya, 2018:76). Therefore, given sufficient time, more accurate designs could avoid or minimise scope variations during execution and thus, result in sustainable performance. Political factors refer to the involvement and commitment of the government in the formation and implementation of legislation and policies that relate to the construction industry in order to achieve sustainable performance (Ametepey et al., 2015:1686; Opoku et al., 2015b:163). According to the authors' findings, having appropriate co-operative policies, strategies and various policy documents could lead to the company’s sustainability. To address the issues of sustainability, government has exerted pressure on construction companies to consider the social and environmental impact of their works (Alotaibi et al. 2019:16). However, successful implementation of policies requires consistency and stability in leadership and in politics (Damoah and Kumi 2018).

Larsen et al. (2015); and Mavi and Standing (2018) identified political stability as one factor that is critical for the success of the projects. Although Gunduz and Yahya (2018:76) most recently found that political conflicts and instabilities have a minor effect on construction project success, in particular in the developed countries, looking at emerging economies such as South Africa, in which construction projects have become a highpoint of development, the effect of the political factor has emerged significantly (Damoah & Kumi, 2018:4). The authors concluded that political conflicts are mostly attributed to changes in government and corruption. Another key political factor is the identification and understanding of key stakeholders in order to ensure project success. Depending on the nature and type of projects

executed, some of the stakeholders are of a specific political alignment, and therefore, their actions could considerably influence the project management success (Mavi & Standing, 2018:761).

Alotaibi et al. (2019:24) examined that companies should consider different perceptions and opinions of stakeholders and formally incorporate them into their strategic decision-making process. Therefore, the company's ability to identify and respond to its stakeholder requirements during the project initiation phase significantly contributes towards its success. Another body of research examined the impact the technical capacity (TC) has on construction industry performance. Gill (2015:95) defines capacity as the "amount of available resources or the output achievable to meet the operational challenges over a specified period of time".

According to Mishra (2018:17), TC in the construction industry refers to different personnel, such as engineers (technical advisor, senior/site engineer, supervisors) and project managers who can be utilised in various positions within the industry. in developing countries such as South Africa, the issue of a low qualified labour force continues emerging due to insufficient training provided to the employees (Horta & Camanho, 2014:974). Also, the rotation of workers to various companies affects company performance, and this could be minimised by ensuring that a relevant TC in terms of experience, skills and knowledge is maintained (Gunduz & Yahya, 2018:76; Senaratne & Gunawardane, 2015:18). Construction companies are faced with a challenge of managing capacity as it requires a strong capital base which makes it difficult for the companies to build additional capacity (Gill, 2015:95). Therefore, companies are tested to have strong abilities in positioning existing resources in an effective and efficient way in order to achieve sustainable performance.

Although Tayeh et al. (2018:310) found that the engineer's capabilities and experience are the most critical factors within TC that influence construction performance, Senaratne and Gunawardane (2015:18) argued that a balanced design team and appropriate distribution of roles to team members has a positive influence in project performance. This applies to both the contractor and the client's technical capacity (Gunduz & Yahya, 2015:76; Mat Isa et al., 2015:18). With the construction industry mostly dependent on continuous innovation and improved business performance, the need for strategic knowledge management is required to gain a competitive advantage (Kamara et al., 2002:53). These changes rely heavily on

professionals to identify changes and develop a research framework for future investigation (Yu & Yang, 2018:782). Therefore, companies should provide suitable training for employees with relevant knowledge management systems to enhance their career prospects, Kamara et al. (2002:54) indicated.

Developing KM strategies that focus on the reassignment of workers from one project to another, the use of standards and best practice guides, and other activities such as post-project reviews could improve the company's performance (Kamara et al., 2002:63). The authors further examined that these strategies could help in the capturing and sharing of lessons learned from other executed projects. Having a deeper insight into understanding the basic factors influencing construction performance could lead to the improvement of consequence factors (Chaturvedi et al., 2018:351). Although some companies possess knowledge management systems, such as knowledge worker systems (KWS) and embedded strategies to improve their performance, Kazi (2005:25) identified three major obstacles attributed to the establishment of a knowledge-sharing culture, and these are briefly discussed below:

● An unsupportive culture – sharing information with other workers minimizes opportunities

● for getting a promotion - workers enjoy holding onto a degree of specialized knowledge that varies from that of their colleagues. Poor communication structures – the company's lack of effective mechanisms and processes.

● to inspire open communication affects company performance - sufficient time should be available to allow workers to engage in knowledge-sharing activities. The research attributed this factor to more focus put on working.

● Responsibilities rather than knowledge sharing - 19 KWS is the tool developed to assist knowledge workers in capturing and organizing "activity information, and help them learn, prioritize, and execute knowledge worker tasks more efficiently and effectively" (Kamara et al., 2002:60).

Most recently, a computational narrative semi-fiction generation (CSNG) approach was developed which facilitates knowledge retention and learning (Yeung et al., 2016:408). The authors realized the application of a CNSG approach is highly effective in providing a realistic experience for individuals to gain lessons learned, and assist workers to learn and remember important things and learning points from the narrative. Durdyev et al. (2018c); Larsen et al. (2015); Mavi and Standing (2018); and Ranawat et al. (2018) identify material availability as other factors that heavily influence construction industry performance. With

50-60% of the construction project costs attributed to material usage (Prasad et al., 2018:15), efficient use and management of material is critical to enhancing project performance.

Durdyev et al. (2018) discovered that the driver and barriers of the sustainable construction industry in Cambodia are lack of materials. Therefore, as a resource that is largely consumed by the industry, its usage should be optimized in order to ensure the sustainability of the construction performance. A larger volume of material used in construction projects is attributed to errors and omissions in the consultant material (Larsen et al., 2015:16). Therefore, using more durable material could minimize material consumption while lengthening the lives of the construction works (Durdyev et al., 2018:14).

The material shortage was further contemplated by Zidane and Andersen (2018:663) in broader research conducted on universal delay factors in the construction industry. Both the client and the contractor's ability to effectively co-ordinate material replenishment could positively influence the project performance, resulting in on-time project delivery (Chaturvedi et al., 2018:352; Tayeh et al., 2018:10). With regards to the South African construction industry, a study conducted by Windapo and Cattell (2013:75) identified the increasing costs of building material as a significant factor influencing the industry's performance. The need for resource shortages cannot be over-emphasized, and this requires all parties involved to develop a 20 proper coordination plan with their respective manufacturers and suppliers to ensure the timely availability of material and equipment.

Despite several studies conducted relating to quality in the past years, there is still no one clear definition of quality. For this study, the following are the three definitions of quality used for examining the influence quality has in construction performance. "Meeting the expectations of the customer" (Larsen et al., 2015:3) ● "Reduce rework or defects" (Larsen et al., 2015:3) ● "A product or service free of deficiencies" (Rumane, 2017:6) ● Broader research has been conducted to determine the effect of quality factors on construction work; Senaratne and Gunawardane (2015:2) found these factors as having a significant influence in construction performance. To the authors' findings, lack of collaboration among parties during the design phase resulted in poor quality performance. The authors highlighted the importance of selecting a design team, adaptation of good team-working practices, and applying a balanced team role as significant factors influencing the performance of the construction industry. The definition of team role is given as "how the individual fits into the

team, not what particular function he or she performs" (Senaratne & Gunawardane, 2015:2). Therefore, having good teamwork practices in construction teams would result in a sustainable performance industry.

Some authors identified human resources (HR) capacity as another aspect to consider for sustaining construction performance. Most recently, Mishra (2018) evaluated the impact HR capacity has on Nepalese construction companies. The author found that the quality of HR relies on the quality of the workforce the company employs, meaning, during recruitment for job opportunities, the company should extend its search to a sufficiently large sample of capable candidates through referrals or use of recruitment agencies.

Retaining a workforce that is capable of producing high-quality performance provides a competitive advantage to the company (Sing et al., 2018:3).
Workforce retention ensures the transfer of experience and knowledge from experienced employees to inexperienced or newly qualified consultants (Larsen et al., 2015:16). Having a capable workforce with relevant skills and knowledge minimizes errors or omissions in tender documents and construction works and reduces the cost of reworks (Larsen et al., 2015; Lindhard & Larsen, 2016; Mavi & Standing, 2018; and Ranawat et al., 2018).

Another factor attributed to poor tender documents is mainly lack of employee involvement and teamwork; unavailability of a skilled workforce; and management not fully committed to quality management (Larsen et al., 2015:668). Without proper controls or measures put in place to alleviate the increase in building material costs, the authors stated that the performance of the construction industry will continue regressing. Evaluating the critical success factors and based on their impact and frequency they possess in sustainable performance of the construction industry, two human resources (HR) factors were identified; effective site management, and availability of appropriate personnel on project sites (Gunduz & Yahya, 2018:76; Tayeh et al., 2018:10). These factors were deemed to be very influential in helping to drive the project to be completed as planned. The issue of HR capacity has been a major concern for many researchers globally. This requires significant attention to achieving sustainable construction performance.

According to Mishra (2018:17), "human resource capacity is about ensuring that an organization has enough people with the necessary skills to achieve its objectives". Sing et al.

(2018:25) identified harsh working conditions, job uncertainties, and lack of career prospects as the major contributors in restricting human resources personnel from joining the industry. To the author's knowledge, workforce sustainability could be overcome by inspiring multi-skilling and the establishment of welfare facilities for construction workers.

For developing countries such as South Africa, government and training authorities' interventions in reviewing labour policies for maintaining a construction workforce could improve human resources capacitation (Sing et al., 2018:26). Funding is required for company expenses such as; payment of subcontractors, employee salaries, and other administrative expenses, which, if not sufficient, could result in slow progress of the work. Adaptability to changing business conditions has a major influence on the performance of the company (Elkhalifa, 2016:197).

Technology transfer has transformed the industry from the ancient labor demand that produced comparatively simple designs and buildings into complex systems and designs (Gunduz & Yahya, 2015:77). Due to the high cost of labor productivity in developed countries, construction projects are more technology-driven than in emerging countries such as South Africa (Chaturvedi et al., 2018:335). Sing et al. (2018:6) discovered that almost 50% of the construction workforce was replaced by automation in Japan's construction industry, This implies that as technological improvements develop, there is a significant impact on the traditional workforce required to execute work (Sing et al., 2018:6). According to Chaturvedi et al. (2018:352), these changes require knowledge management mechanisms to transfer and exchange skills and knowledge obtained from various projects. This will assist in advancing good project implementation practices which could result in sustainable performance in the construction industry.

Hove & Banjo (2018) indicated that construction performance has a significant contribution to the country's economic development. However, Rahman and Ali (2018) argued that its performance has been closely monitored by many researchers due to the pollution it generates from construction activities. To the authors' knowledge, a blanket approach is not used when determining construction regulations as they are often country-specific. Therefore, their degree and nature may differ, depending on the type of construction work to be executed. Hence, in analyzing project success factors in the Middle East Region, factors such as sudden

changes of law and regulations were ranked as the least important factors influencing construction performance (Gunduz & Yahya, 2015:76).

The issue of regulation such as lack of statutory requirements is a concerning factor in sustainable performance in developing countries (Durdyev et al., 2018c:14). In a study conducted in Iraq, a model (Bayesian Decision Tree Approach) developed to evaluate the impact of modification to the regulations proved that modification has an impact in the quality of work performed (Naji et al., 2018). The authors found that adding more regulations to the construction project processes resulted in a high level of quality, however, more time was needed to execute projects. Having an apparent statutory process that incorporates sustainable construction practices with economic incentives could result in the effective implementation of sustainable construction initiatives (Durdyev et al., 2018:570).

Another factor that impacts the construction industry's performance is job satisfaction. Enshassi et al. (2016:1) classified several factors that are considered to contribute to job satisfaction at work. In the authors' findings; emotional exhaustion, depersonalizstion, and reduced personal achievement have a great influence on the performance of the workers. These factors were attributed to unfair rewards and recognition, job security, and workload which contributed to the exhaustion and fatigue of the workers. These factors were also perceived to result from the dynamics and complex nature of the industry's activities, different backgrounds, and attitudes of the workers towards the quick changes developing within the construction industry (Enshassi et al., 2016:43). Enshassi et al. (2016:43) examined that "staff members under stress interact less frequently with clients and engage in fewer positive interactions with clients". Investigating the impact of competitive conditions on supplier evaluations,

Seth et al. (2018:230); and Ye et al. (2015:9) found that market competition has a major influence in the performance of the construction industry. More than just determining the company's ability to survive in the market, market competition also encourages companies to have innovative ideas to maintain their sustainability (Widuri & Sutanto, 2019:172). However, the authors identified that higher market competition also increases a company's probabilities of insolvency as it reduces the company's profitability. Seth et al. (2018:230) determined three ways in which market competition influences construction industry sustainability, and they are briefly discussed below; "Positive effects in the economic

dimensions – the stronger the market competition, the better the industrial performance in the areas. Negative effects on the environmental dimension – the higher the market competition, the larger the consumption of solid waste, and steel consumption. Positive effects on the social dimension – the higher the market competition, the better the competition of construction sustainability performance" The above impact is predominantly observed in the construction industry due to the market's perfect competitiveness.

Dating back to 2017 when the construction industry's annual growth rate contracted by 0.3%, the industry continues to weaken due to intensifying competition (SACI Report, 2018:31). To achieve success in construction projects, one needs to demonstrate the ability to co-ordinate activities performed by various individuals with a high degree of complexity and risks (Larsson et al., 2015:12), and this is referred to by the authors as leadership. Opoku et al. (2015a:185) defined leadership as a process in which a certain or a particular individual influences a group of people to acquire common objectives. This is mainly an executive position within the company, although the authors believed that leadership could emanate from all different levels of positions within the company. Companies require individuals who are fully committed to what they do to ensure the company's survival and competitiveness in the market.

Ametepey et al. (2015:1688) and Ranawat et al. (2018:10114) identified several leadership factors that have a major impact on the company's sustainability. The impact of financial constraints on the implementation of sustainable performance in the construction industry has been acknowledged by many studies, such as Ametepey et al. (2015); Ranawat et al. (2018); and Windapo and Cattell (2013). The authors identified additional financial costs as one of the major barriers in providing sustainable performance in the construction industry, and this result in lack of the realisation of the sustainable concept. Most recently, the issue of corruption has been observed by many authors, such as (Chan & Owusu, 2017; Niazi & Painting, 2017; Owusu et al., 2019), as a global concern in the construction industry. The studies showed an increase in construction industry corruption over the past decade which is a worrying factor for the industry.

Fellows and Liu (2016:247) referred to socio-cultural factors as the sense-making explanations which "satisfy individuals' needs for achieving coherence, consistency, and legitimacy in thoughts and actions". Many authors have alluded to the importance of good

construction performance to economic development, providing infrastructure to developing countries such as South Africa becomes the backbone of the society for socio-economic development (Das, 2018:15). As technology continues to develop, cross-cultural problems and complexities of the project also continue increasing (Ranawat et al., 2018:10108). Per the authors' findings, an appreciation of people's different sentiments and how they perceive their worlds allows participants to appreciate the opinions of others and thus mitigates potential problems.

Generally, it is believed that culture influences how individuals perform. Therefore, a constructive engagement of all affected stakeholders before the execution of the works is vital. According to Das (2018:15), the success of the project also lies in the stakeholder's effective participation. By involving stakeholders, the likelihood of reduced performance and community conflict situations could be minimised. The civil construction sector is a project-based industry that encompasses various firms in temporary multidisciplinary organizations, to produce infrastructures, such as roads, building, and factories (Kamara et al., 2002:55). The SA construction industry is diverse and fragmented, with the construction of civil engineering structures and the construction of buildings being the most dominant (Windapo & Cattell, 2013:65). As in any other nation around the world, the industry contributes significantly to the country's socio-economic development (Windapo & Cattell, 2013:65). The Construction Industry Development Board (CIDB) is the statutory body established in 2000 to provide an integrated construction industry development strategy (CIDB, 2014:2). This statutory body is also responsible for the overall measure of the industry's performance.

In South Africa, contracting companies that registered with the CIDB are graded according to their ability to perform works within classes of works in the construction sector. Doing business in the SA construction industry Legislation and policies have been developed by the local government which encourage open markets, innovation, and a more competitive market (CIDB, 2018:1). However, the report indicated that some of the legislation could discourage investors from doing business within the country. In a study conducted by the World Bank Group in 2018, South Africa was rated number 82 in 2018 among the top 190 countries in the world in terms of difficulties in doing business in SA (Doing Business in SA [DBSA], 2018:29). The ease of doing business in SA has continued to be challenging since 2016 and is becoming more difficult. South Africa was ranked 73 in 2016, with a rank of 1 being the easiest to do business with. The ranking continued to decline with 2017 and 2018 being 73

and 74 respectively. Moreover, before any execution of construction works, 18 procedures are required to take place as a construction permitting process (DBSA, 2018:28). To the report's findings, it takes an average of 125 days to get all the approvals, and these contribute to 2.2% of the total construction works. This includes inspections and all necessary documents required, such as permits required before, during, and post-completion of the works. According to Doing Business in SA (2018), compared to other industries, the construction industry plays a big role in South Africa's economy and contributes significantly to employment and economic growth (CIDB, 2018:25). With 4% of contribution to the country's GDP, construction remains the biggest contributor to Gross Fixed Capital Formation (GFCF).

Two main determinants of construction industry performance are the public sector and the private sector, with state-owned entities (SOEs) being the largest contributor to public sector spending (PricewaterhouseCoopers, 2016:7). The actual capital expenditure relates to new construction, property development, and other restored projects incurred by the public sector, where the forecast capital expenditure represents projections made in the preceding year. The majority of this decrease is attributed to reduction in capital expenditure by government enterprises.

The other significant contributor to capital expenditure in the construction industry is the private sector, with mining being the largest player (PricewaterhouseCoopers, 2016:9). The mining sector also experiences challenges in which mining companies are seen to be reducing their capital expenditure, particularly from 2014 to 2016. The construction industry is responsible for 9.4% of construction Gross Fixed Capital Formation (GFCF) of the country's Gross Domestic Product (GDP) (CIDB, 2018:99). It also employs over 609 000 people, with civil engineering and building construction contributing to 369 000 and 209 271 respectively (Construction Monitor [CIDB], 2018:2). This makes the industry the second-largest employer following the government (Doing Business in SA, 2018:29). The construction industry contributes the biggest share of the total construction fraternity, which amounted to 63% of total GFCF (Construction Monitoring Report, 2018:4)

According to David and Jason Hickey (2021), the term "economic development incentives" refers to a range of financial and technical resources that are available to utilities, government

agencies, and organisations that promote economic development, among other similar entities. To support businesses, these incentives could take many different forms. They could be in the form of cash grants, rebates, credits against certain tax liabilities, direct grants in the form of cash or forgivable loans, financing and aid for site development and infrastructure, loan support, financing for job training initiatives and programmes like green technologies and sustainable practices, etc. In order to assess and obtain economic development incentives, companies need to carry out appropriate research and due diligence in order to determine the actual worth of pertinent incentives (as well as the conditions of the corresponding future commitments). Similar to how economic development incentives differ nationwide in terms of their value, composition, and characteristics, so do the laws and policies that govern them. For the business to achieve the best results in the short and long terms, a strategic approach and action plan are essential. The investment's location in an urban or rural community should be considered carefully when assessing these opportunities, the report revealed.

The creation of public-private partnerships, which establish bilateral or multilateral legal relationships between the recipient business and other potential stakeholders, is the usual method used to deliver economic development incentives. Government agencies at the state, local, and utility company levels, collectively known as economic development organisations, or EDOs, are primarily responsible for managing business incentives, although the federal government also provides some. Within their borders, EDOs aim to draw and keep businesses. Though this isn't always the case, EDOs will usually work together to develop a comprehensive incentives package that best suits the prospective company. As state legislators regularly modify current programmes to implement policies and programmes that support economic development within their borders, state governments are a common partner for business incentives. Discretionary cash grants, financing assistance, and tax incentives are the most common forms of state incentive programmes (Paul Ekins & Dimitri Zenghelis, 2021).

Paul Ekins & Dimitri Zenghelis, 2021) also believed that Municipalities and counties have different levels of discretion and authority when it comes to incentives. Since these are areas mostly affected by capital investment and job creation, the incentives provided at the county and municipal levels usually take advantage of the capacity to provide funding for job training, property tax abatements, consumption tax exemptions, and tax increment financing. Utility providers are increasingly using incentives to support growth and retention, especially

for industrial, logistics, and data centre projects, as they are a vital resource for economic development in their jurisdiction. Businesses can receive funding and financing support from the federal government; these are usually given in addition to incentives from local, state, or county governments. Small business financing, grants for infrastructure and economic development, workforce training, and targeted employment programmes are just a few of the programmes that fall under this category. By offering different types of direct and indirect financial support to businesses, business incentives aim to stimulate economic development in American communities. Governments that offer such support anticipate that the businesses will do the same by generating employment and investing in facilities, machinery, and other assets that will eventually improve the local economy, says Ojo-Fafore, Aigbavboa and Remaru (2018).

According to Andrew Matheny's (2023) research, a lot of communities are willing to offer incentives to businesses that have a track record of being reliable community partners. Retention-focused incentives are frequently the ones that are most disregarded. Even when existing real estate is well-suited for current operations and well-located to attract talent, financial considerations frequently prompt companies to explore relocation. Many communities are willing to offer incentives to companies that have a track record of being reliable community partners in order to keep them around. In these situations, financial incentives could provide a strong reason for businesses to stay put and save money on real estate by remodelling current space, combining several locations, or making modest, incremental expansions.

Andrew Matheny (2023) also indicated that a corporation needs to be sure it isn't passing up opportunities by taking incentive options into account early in the decision-making process. An organization can lower operating costs and boost net income by knowing how incentives affect its operations, workforce, structural costs, tax liability, and financial statements. It can also do this by using strong technology and data analytics to find the best opportunities. Experts in incentives improve clients' performance by knowing the local business climate, tax landscape, and the priorities of different economic development organisations. They understand which initiatives could produce the intended results and how to craft an engaging narrative that unites an organization's objectives with those of their local communities.

Claw-back clauses are used by governments as a safety measure to guarantee incentive agreements accomplish their intended objectives. For instance, in order for a government to grant a tax credit to a business for moving 50 jobs, the recipient usually needs to keep a specific number of employees for a period of five years. The government may end the agreement and demand repayment if the company's employment ever drops below this threshold. Conditions and restrictions are always just as significant as the value of the financial reward. Companies need to be aware of the terms and conditions outlined in the term sheet and final agreement before completing an incentive. If conditions change, renegotiation might be feasible, but it might be expensive in terms of money and reputation. Incentives can yield significant returns, even though they are not the only consideration in real estate decisions. For this reason, professionals adept at assessing, negotiating, and carrying out these kinds of agreements are frequently called upon to assist with a real estate assignment. Furthermore, since incentives are always changing, the best way to maximize outcomes is to have access to current and past deals to compare opportunities across industries and geographies and against quantitative and qualitative benchmarks. It is in everyone's best interest to review incentive contract obligations, pay attention to applicable laws and program requirements, and comprehend the impact on present and future performance criteria given the difficulties businesses continue to face (Chan, Darko, and Ameyaw, 2017).

According to Enayat et al. (2020), localizing sustainability necessitates radical change that could defeat incrementalism's propensity to uphold the status quo. Long-term objectives that represent desired results should be used to guide the transformative change (i.e., the successful future for a community, city, or business). These objectives stand for the common social, environmental, and economic aspirations of a society that local actors ought to be moving towards. A sequence of short-term (low regret) and long-term (high investment) actions could be taken to accomplish ambitious goals and bring about transformative change. It can be difficult to reconcile conflicting priorities and power dynamics amongst stakeholders when defining objectives and course of action in a local setting. In order to do this, researchers must participate in a deliberative learning process with societal actors in order to consider current objectives and course of action and to collaboratively develop new ones through sincere stakeholder engagement from the bottom up. In order to mobilise coordinated efforts that are socially desirable, actionable, and mindful of environmental limits, it is helpful to jointly frame context-specific goals and actions. Potential future

instabilities (e.g., technological disruption, political volatility, ecological disasters) are likely to disrupt the effectiveness of actions and the achievement of localised goals. Uncertainties must be carefully considered before making decisions. As time goes on, there might be greater disagreement about what would happen in the future, which could increase uncertainty about these events and how they would affect long-term objectives. Whether at the local, national, or international level, evaluating disruptive scenarios through careful consideration of significant but uncertain factors is necessary for localising sustainability. Some of these factors could be informed by stakeholder deliberation. A methodical examination and analysis of how well actions accomplish long-term objectives and how well they enable challenging trade-offs between competing priorities are also necessary for the evaluation. The process of identifying methods to lessen the effects of future uncertainties and their disruptive effects, such as stress testing, could be facilitated by an a priori assessment of uncertainties and their implications. To accomplish long-term objectives in the face of uncertainty, more is needed than isolation, what is needed is an adaptive plan, or a schedule of limited, time-specific actions that can direct local actors over time. A roadmap like this could help determine what steps to take, when to take them, and how to supplement them with other safety measures in case future instability strikes.

Chan, Darko, and Ameyaw (2017) noted that the concepts of pathways and adaptability have been put forth by sustainability science and development studies to improve the ability to modify responses under changing conditions through discussion, learning, and negotiation. As a result, given various local contexts, pathways comprise efficient short- and long-term action sequences that can mold the desired future. Additionally, pathways can adapt to unknowns in the future. They have signposts to track shifting conditions and alert users when the system is about to reach a tipping point. Tipping points are thresholds that indicate when existing actions are no longer effective and new ones are needed. These thresholds can be either beneficial (such as a groundbreaking discovery or solution) or negative (such as an environmental catastrophe). An adaptive plan can assist local actors in proactively navigating alternative courses of action toward accomplishing long-term sustainability goals as time goes on, as their knowledge of the surrounding environment changes, or both. An adaptable plan for localizing sustainability is the process's end product.

According to Hickey (2021), a company might find it daunting to take into account every possibility for economic development incentives available in the US. This section offers an

overview of the most prevalent incentive options that businesses may be eligible for, even though it isn't meant to be a comprehensive list of all of them. Businesses that collaborate with the appropriate EDOs would receive customised incentive packages from the organisations that are based on discussions and agreements with the company related to the particulars of the project that is being proposed. EDOs create and plan these ideas in order to maximise an incentive programme for the company. The ultimate goal of incentives is to provide the necessary backing so that a business could feel confident enough in its business case to commit capital. These kinds of corporate income tax breaks are frequently conditional on the business agreeing to increase employment levels and/or make sizable capital expenditures. The tax liabilities resulting from the project and the company's operations in that specific taxing jurisdiction, the incentive's duration, the possibility of credit carryover and the incentive's refund ability are all important considerations when evaluating a corporate income tax incentive. In the latter case, the business would be able to realise the incentive's value whether or not it actually owes taxes because the tax credit is refundable. The remaining $50 will be given in another way, usually in the form of cash, if the business only owes $50 in taxes and the tax credit is worth $100. On the other hand, should the programme not be refundable, the company would have to have $100 in actual tax obligations in order to receive the entire incentive value. Governmental organisations frequently impose variable consumption taxes, also known as sales and use taxes, across the United States. Economic developers may use incentives to leverage these tax exemptions in order to attract businesses and stimulate investment. Therefore, in order to properly assess the opportunity, businesses must be aware of the details surrounding their investments, especially those related to equipment. Additionally, some states might exempt certain costs, like industrial machinery.

To properly assess the true value of these kinds of incentives, businesses need to be aware of the goods and services that are taxable in the relevant jurisdiction, the timing of the investments, depreciation schedules, and filing requirements, among other things. Tax Incentives for Workers Payroll taxes are the main method used by numerous state and local governments to impose taxes on employment. EDOs might be able to provide incentives in those areas that would lessen or completely remove this tax burden on companies. These programmes could also be offered as a post performance incentive, in which case the business would receive a refund of the payroll taxes it paid, subject to the business meeting project milestones. Many jurisdictions offered grants to businesses for projects aimed at economic development. Grants are given out by a wide range of organisations and

governments, including local governments, state agencies, the federal government, and other stakeholders in regional economic development. In the past, grants were frequently given to projects to help them move forward with their investment. In order to lower the upfront cost to the taxpayers, these programmes have moved to the post-performance model today. A post-performance grant also presents less of a risk to the company in terms of "claw-backs," or repayment, in the event that the project does not materialise as planned, Hickey (2021) indicated.

Putting money into essential infrastructure is a crucial component of any successful economic development plan. EDOs frequently have resources to promote the expansion of infrastructure, including support for broadband, electricity, transportation, water and wastewater, and site work. Economic developers may be able to use funds and resources from national and local government agencies, including the Economic Development Administration (EDA) and Community Development Block Grants, to support a project. Even though these programmes frequently don't offer the company direct financial support, they could nevertheless be used to guarantee and support the availability of the essential infrastructure required for projects as well as for future growth. Numerous gases, electric, and other utility companies have set up their own internal economic development initiatives in an effort to attract investment into their respective jurisdictions. Utilities frequently work directly as partners with companies and EDOs at the state and local levels to support investment projects. Industry rate riders and other tools and resources, such as transmission and extensions for the gas and electric infrastructure, might be used to achieve this. Rate riders are incentives that offer discounted electricity rates for projects promoting economic development, resulting in significant short- and long-term cost savings. Programmes to support green and sustainable investments are also utilised by numerous government agencies and utilities. For companies making investments in the US, having sufficient and appropriate financing is essential, particularly when first entering the market. For specific projects, businesses might be able to obtain zero-to-low interest loan financing through federal, state, and local EDOs. Both large corporations and small and medium-sized enterprises could benefit from the lending support (Shan, Hwang, and Zhu 2017).

Because terms and commitments could change based on the location, scope, and financial need of a project, it is imperative that businesses look at the possibility of financing support

in addition to traditional lending options. Incentive programmes for job training aimed to assist the investing company as well as the community. By providing and implementing new skills, the community helps to develop its workforce in addition to the business, which benefits from critical financial and technical support for employee training. Most of the time, these workforce development programmes are made to either channel such training through a nearby academic institution or reimburse businesses for training activities that meet certain criteria (Milanese et al, 2022).

Shan, Hwang, and Zhu (2017) believed that businesses should have to create a training plan and assess how they could secure resources to meet their unique skill needs. Businesses could also take use of additional incentives offered by both the federal government and municipalities to aid in growth and funding. Complex incentives require more legal architecture and due diligence to be employed to their full capacity. Opportunity Zones and New Markets Tax Credits are a couple of these incentives that can be used in certain federally designated census tracts that meet certain requirements and have been identified for economic development. For projects that qualify, investors in each of these zones could save a sizable amount of federal taxes. Enterprises have the option to engage in direct investment or collaborate with current zone investors to reduce development costs and obtain essential project funding. Tax Increment Financing (TIF) is another sophisticated incentive used for economic development, frequently found at the local level. This development tool supports project financing by utilising projected future property tax revenues. These funds may be used for project support in a number of ways, including financing, site and infrastructure support, and even workforce development training, depending on the location. A company must approach economic development incentives strategically in order to guarantee project success and lower business risk, given the vast array of potential business incentives. The dynamic economic development incentives process has essential steps and best practices, the report noted.

Bank loans, green bonds, international assistance programmes, government grants and tax incentives, and private capitals are the five prevalent financial vehicles that have been widely used for sustainable construction, according to Shan, Hwang, and Zhu (2017). According to the study, bank loans were among the most popular financing options for environmentally friendly building because of their great degree of flexibility with regard to terms (like long-

term and short-term) and types (like secured, unsecured, demand, subsidised, and concessional loans). Many banks all over the world have been consistently setting up loans to finance the creation of sustainable built environments for the past 20 years. For example, in May 2007, Citigroup introduced a USD 50 billion green lending programme. The review noted that banks' perspectives regarding loans for sustainable development appear to differ in terms of magnitude, even though they actively participate in the sector. American Bar Association's Section of Real Property and Law observed that smaller regional banks are more willing to finance sustainable development than larger banks. They provide a number of preference programmes for sustainable development, including higher loan-to-value ratios, lower interest rates, waivers for the first mortgage premium for the development of green commercial buildings, and preferred project reviews. Greater banks, on the other hand, tend to be more conservative. Projects for sustainable development are typically handled the same way as traditional development projects. Green-specific factors are taken into account during project reviews. Nonetheless, generally speaking, they continue to award loans based on the project's foundational elements. Apart from their benefits, bank loans also have certain drawbacks that have been documented in the literature. High financing costs, capped credit limits, and convoluted bank approval processes were some of these drawbacks, the study revealed.

The World Bank stated that bonds are essentially debt securities that are sold and purchased by corporate entities in order to raise money for specific development purposes. Regarding green bonds, they are essentially debt securities that are sold to raise money for environmental projects, including sustainable building initiatives. Review stated that during the last ten years, institutional investors and financial institutions have given green bonds more consideration, and they are now widely used to finance environmentally friendly building projects, according to Windapo and Cattell (2013). The most active financial institutions in supporting sustainable construction through the issuance of green bonds are multilateral banks in particular. To help with the development of sustainable built environments in Africa, for example, the African Development Bank issued a USD 500 million green bond in October 2013. A EUR 600 million green bond with a primary focus on renewable energy and building retrofits for energy efficiency was issued by the European Investment Bank in 2007. The World Bank has issued green bonds totalling more than USD 10 billion equivalents since 2008 to support at least 70 sustainable development projects in developing nations. These multilateral banks' green bonds have greatly accelerated the

financial market for sustainable construction projects and drawn significant investment to this kind of venture. The review also revealed that private sectors have recently shown interest in green bond issuance to fund environmentally friendly building projects (Ametepey et al. 2015).

A number of international financing institutions have recently offered a number of international assistance programmes to support sustainable development globally, especially in developing countries. These funds include the Global Environment Facility (GEF) Trust Fund, Special Climate Change Fund, Least Developed Counties Fund, Nagoya Protocol Implementation Fund, and Adaption Fund. The financing of the development of a sustainable built environment was one of these international assistance programmes' top priorities. For example, the Sino-Singapore Tianjin Eco-City development was sponsored by a USD 6.16 million grant from the Global Environment Facility Trust Fund. Four areas received the grant: transportation management, energy utilisation, integrated water technical assistance, and green building construction. It was also possible to detect a commonality among these foreign aid programmes when examining their funding, which is essentially restricted to a certain degree. Even so, these international aid initiatives are beneficial and even essential for funding sustainable development. This is because international assistance programmes can serve as living billboards for those environmentally friendly building projects, drawing in additional funding and investments. When a project receives funding from an international assistance programme, its viability and feasibility have been established because, for the most part, these programmes have very stringent and rigorous evaluation procedures. Governments everywhere are also supporting sustainable construction by giving grant preferences an increasing amount of support. The United States Department of Housing and Urban Development, for instance, established several financing programmes, including the Public Housing Capital-Energy Conservation Retrofit Investment Programme, the State Energy Programme, and the Energy Efficiency and Conservation Block Programme, to support housing projects and help them meet energy star construction and appliance purchase standards. Singapore launched several incentive programmes (such as the Green Mark Incentive Scheme for New Buildings in 2006 and the Green Mark Incentive Scheme for Existing Buildings in 2009) to promote the development and construction of green buildings among local developers, building owners, and project consultants. The governments of some nations are comparatively simpler. They directly allocated financial subsidies to environmentally friendly building initiatives (Wang et al. 2009, Catalina et al. 2011).

To support the development of Sino-Singapore Tianjin Eco-City, a megaproject aimed at sustainable construction, the city government of Tianjin, China appropriated CNY 299.72 million (about USD 44.18 million) between 2013 and 2015. Governments all over the world have implemented tax incentives in addition to grants as a means of financing the advancement of sustainable construction. Energy Investment Tax Credit, Tax Credits for Energy Efficiency Improvements to Existing Homes, Residential Energy-Efficient Property Credits, Energy-Efficient Commercial Buildings Deduction, and Energy-Efficient New Homes Tax Credits are just a few of the many tax incentives that have been introduced in the United States. It has been reported that the Tianjin government refunded a portion of the project's taxes to support the development of the Sino-Singapore Tianjin Eco-City. But over time, they come to understand that this specific investment could yield respectable financial returns. They raised these investments as a result. Sustainable building investments have been made by a significant number of Real Estate Investment Trusts globally in recent times. For instance, LEED Silver buildings were created for corporate tenants by Liberty Property Trust and Corporate Office Properties Trust. This is because they believe that investing in sustainable buildings is a better idea because they can draw in higher-quality tenants and are easier to lease up. Corporate Office Properties Trust is an additional example. In 2005, the National Associations of Industrial and Office Properties Green Development Award were given to 318 Sentinel Drive, located in the National Business Park in Annapolis Junction, Maryland, as one of its sustainable construction projects. Even before construction was finished, the project, a four-story office building with 125,000 square feet, was completely leased. Many private funds have been donated to renovate historic buildings with green features in addition to investing for financial gain. For instance, the Ecotrust organisation in Portland, Oregon, was able to transform a century-old warehouse into a contemporary 70,000-square-foot building through aCredits significant donation from a single donor. When it was completed and opened in 2001, this project became the second LEED gold-certified project in the US, According to Akadiri et al. (2013).

According to Channell (2023), following building codes is crucial to reaching net zero. These establish minimal requirements to guarantee that structures are secure, energy-efficient, and suitable for their intended use. The government recently announced modifications to the building codes that would take effect in June 2022 and mandate a 31% reduction in carbon emissions for newly constructed homes. This intends to reduce carbon emissions from new

homes by up to 75–80% when compared to current levels. It is important to remember that people are more likely to do something if it is simple to do, regardless of the stage at which it is done. Increasing energy efficiency is one of the most effective ways to improve sustainability. All new buildings should incorporate energy efficiency measures to meet regulations and accomplish this. It's also anticipated that policies aimed at retrofitting energy-saving features into already-existing buildings will be unveiled shortly. Installing energy-saving features like solar panels, double or triple-glazed windows, lots of insulation, energy-efficient lighting, and smart building technologies, like heating specific zones instead of the entire building, could help make buildings more energy-efficient. However, adopting more energy-efficient work practices can also include things like using well-maintained, high-quality machinery that consumes little energy.

Long-term funding and investment are necessary for sustainable building. Public budgets have historically been a significant source of funding for environmentally friendly buildings. However, private capital is also required for sustainable construction due to the pressure on public budgets. The sustainable construction sector has seen a surge in private capital inflows from private companies over the last ten years. Initially, private companies—especially those in the real estate industry—invested in sustainable built environments primarily to enhance their reputation for corporate social responsibility (Ayarkwa et al., 2022).

2.4. Influence of economic benefits on the decision-making process of building owners and property managers when considering the use of innovative materials for greener built environment.

Energy-efficient buildings are more valuable and improved operational efficiency and lower operating expenses (Christensen, Robinson, and Simons 2018). Property managers could promote sustainability agendas by maintaining Eco-certifications, participating in Eco-bench-marking, and managing green leases. Businesses could deliver specialized goods and greater services by learning about customer preferences (Chikwuado 2020). It was claimed that the impact of sustainable management of commercial properties on investment returns does not totally negate the goal of cost maximization. Chikwuado (2020) believed that sustainable management is the abstract capital that effectively preserves property value over the course of

real estate investment. Sustainable management is not just about harmony. Only development that successfully strikes a balance between social cohesion, environmental stewardship, and economic effectiveness could be sustained over time (Jackson 2021).

According to Van Wyk, Ireze, & Venter Peet (2023), it is reasonable to believe that SDM and strategic decisions must be in line with the essence of the organisation. Strategic decisions will essentially be "filtered" by the decision-maker and the entity's characteristics. The literature is consistent with the use of staff or employees as influencing factors. However the "engine" is a special kind of influence that draws attention to the "soft elements" (processes, frameworks, and standards) of infrastructure rather than the managerial and physical infrastructure that are typically highlighted in literature. In SDM literature about SMMEs, structures were identified, but these included managerial or decision-making structures. In this situation, the decision-maker would, for instance, assess whether the frameworks, standards, and procedures in place can support the strategic choice or if they need to be modified. Opportunities and/or limitations emphasised the individual's and the entity's time and capacity, respectively. Although time and capacity haven't been specifically mentioned in the literature, time and resources might be connected.

Coetzer et al. 2019; Hang & Wang 2012) discovered that the resources mentioned in the literature are primarily financial, human, and technological. Time and capacity might be crucial components of SDM for smaller-scale SMMEs due to their size, as they can present opportunities or limitations. Because of their small size and scope, small, medium, and micro enterprises are either able or unwilling to implement a strategic decision. In addition to highlighting the financial potential and fuzzy feel-good aspects as influencing factors, rewards in and of themselves were a unique finding. Neither the general SDM literature nor the SDM literature about SMMEs specifically highlights rewards. The organisation of personnel and procedures (operations) is determined by these main and supporting drivers. Depending on the time and capacity that operations would either limit or create, in turn, operations either create new opportunities or introduce new constraints. The primary outcome of the system, which is the financial and emotional rewards, is determined by the constraints (SDM).

When SMMEs engage in effective SDM, knowing the influencing factors and their relationships might improve environmental scanning, SDM, and long-term performance.

Understanding the factors that affect SDM and how these factors interact could help managers or owners of SMMEs better understand their own SDM procedures and explore ways to reduce external influences. Furthermore, being aware of the distinct and particular influencing factors heightens awareness and sensitivity to the factors that impact SDM, ultimately facilitating efficient environmental scanning and information gathering. Understanding the factors that affect SDM in SMMEs can help policymakers, government agencies, and organizations that support SMME development and sustainability make decisions, organize workshops, and implement programs. The nation's economy heavily depends on small-, medium-, and microenterprises (SMMEs). According to Ayandibu & Houghton (2017) and Taiwo, Falohun & Agwu (2016), they support economic growth, innovation, job creation, and employment opportunities. SMMES must survive over the long run to address some of the nation's problems, like the high unemployment rates. Nonetheless, SMME failure rates are high in some countries. Their failure rate could be attributed to several factors, such as poor managerial practices (including strategic decision-making [SDM]), insufficient funds and infrastructure, risks arising from economic factors, and small networks (Masama & Bruwer 2018; SEDA 2016). For businesses of all sizes to succeed and function well over the long run, effective SDM is essential. One of the two major research streams in strategic management, the strategy process, is related to strategic decision-making (Burgelman et al. 2018; Hang & Wang 2012).Small businesses could be categorised as micro, very small, small, or medium-sized entities in some countries (Nene 2017). Small businesses, small and medium-sized enterprises (SMEs), and SMMEs are terms that are commonly used to refer to smaller scaled businesses in literature. Smit and Watkins (2012) noted that these terms are sometimes used interchangeably. Fifty to sixty percent of all workers in South Africa are employed by small, medium, and micro-sized businesses in the private sector (Nene 2017; Olawale & Garwe 2010). The decision-making, procedures, employee turnover, market share, and informal bureaucratic structures of SMMEs are different from those of larger organisations (Ayandibu & Houghton 2017; Coetzer, Wallo & Kock 2019; Liberman-Yaconi, Hooper & Hutchings 2010; Taiwo 2016). Their insufficient decision-making abilities and knowledge might be a result of the many obstacles they encounter, including scarce human, financial, and technological resources. Furthermore, it is highly probable that a single person, rather than a group, makes decisions in SMMEs. According to Ayandibu & Houghton (2017), Hang & Wang (2012), Savur, Provis & Harris (2018), these traits have an impact on SDM, behaviour, and processes.

The survival prospects, overall scope, well-being, and nature of an organisation are significantly impacted by strategic decisions, which are deliberate and significant actions (Alsmairat, Alhawamdeh & Alsmairat 2019; Liberman-Yaconi et al. 2010; Schoemaker 1993). Complexity, uncertainty, rationality, control, and politics are characteristics of these decisions (Campos et al. 2015; Schwenk 1995). Understanding SDM in SMMEs is crucial since any economy depends on their long-term viability. According to Bruwer 2020, Fatoki 2020, Masama & Bruwer 2018; Mlotshwa & Msimango-Galawe 2020, this is particularly true for developing nations as a whole. These knowledge additions might help SMMEs better understand and manage their SDM and pertinent environmental scanning, which may enhance their chances of surviving.

According to Burghers, Andriessen & Nicolaes (1998), Hang & Wang (2012), Shepherd & Rudd (2014), and other sources, the influencing factors of SDM could be divided into four categories: individual (or managerial) influencing factors, internal, external (or environmental), and decision-specific factors. The traits and profile of the individual (or manager) are among the individual factors that are similar. Individual factor differences include decision-making behaviours such as approaches to information search and dependency or independence in decision-making (Jansen et al. 2011; Liberman-Yaconi et al. 2010) and entrepreneurial dynamics (Forbes 2005; Hayward et al. 2017). These variables might have something to do with a manager's capacity for metacognition. Resources and decision-making and organisational structures are examples of internal factors. Employee impact on organisational structure may be related to ownership, whereas entity type (i.e., family or micro entity) might be related to ownership. However, because of the informal nature of SDM in SMMEs, power and politics were found to have less of an impact on the practice (Brouthers et al. 1998).

Kolk (2005) contended that soft measures and voluntary adjustments only result in marginal reductions of environmental impacts; they do not, however, bring about fundamental changes in production and consumption, which, in accordance with the Porter Hypothesis (Porter and Van der Linde, 1995), necessitate strict regulatory measures implemented by governments. The SDGs are already covered by a number of regulatory frameworks. However, calls for regulation to help achieve the SDGs have not yet been able to identify precise incentives and ways to ensure compliance in the majority of studies (Caiado et al., 2018). Alternatively, Kolk (2005) proposed that rather than waiting for more stringent regulatory approaches

through public legislation that reduce flexibility and increase compliance costs, firms could take the lead in implementing environmentally responsible practices guided by voluntary codes of conduct and self-regulation, such as through standardization and standards.

In addition, D'Amato et al. (2019) disclosed that numerous businesses design their sustainability practices based on voluntary national or international standards in order to function and justify their sustainability initiatives. Even so, Ikram et al. (2021) and Hörisch et al. (2014) specifically identified standard setters as a particular stakeholder group that works with regulators to establish framework conditions that motivate stakeholders to advance sustainability. This is consistent with Kivimaa et al.'s (2019) perception of standard-setting bodies as specialized intermediaries facilitating transitions toward sustainability. Hörisch et al. (2014) discovered that setting standards is a tool to raise awareness among businesses and other stakeholders to foster shared sustainability-oriented mindsets. In their published standardization strategy, the European Union recently emphasized the value of involving the relevant stakeholders in the standardization processes, as this could promote openness, transparency, and inclusivity (European Commission, 2022).

Hörisch et al. (2014) discovered that setting standards is a tool to raise awareness among businesses and other stakeholders to foster shared sustainability-oriented mindsets. In their published standardization strategy, the European Union recently emphasized the value of involving the relevant stakeholders in the standardization processes, as this could promote openness, transparency, and inclusivity (European Commission, 2022). Nonetheless, there is a dearth of comprehensive data regarding the inclinations of companies, in particular, to support the SDGs.

Yamane and Kaneko (2022) expose discrepancies between the priorities of companies and the preferred SDGs of other stakeholders SDG, or Zero Hunger that is favored by the public but is given less priority by industry. Companies, on the other hand, prioritized SDG 8, "Decent Work and Economic Growth." More broadly, a multi-criteria decision analysis framework is presented by Allen et al. (2019) to prioritize SDGs using approaches that are grounded in science and evidence. Standards and standardization support the development of new technologies and innovations as well as their adoption and diffusion (Blind, 2016). By coordinating the disparate interests of numerous stakeholders and sharing information and regulations among them, standardization processes can aid in the dissemination of societal

missions and are crucial in addressing the SDGs (Balzarova and Castka, 2012). However, because of lock-in effects, established standards can also impede the spread of innovations and the move towards more sustainable solutions. The industry's desire to capitalize on the market-based economic benefits of standards—that is, to achieve compatibility, reduce information asymmetries, and realize economies of scale through variety reduction—drives standardization processes (Blind, 2004; Swann, 2000).

Botzem and Dobusch, (2012) indicate that standards could provide legitimacy to innovations and new technology and foster trust by providing a thorough disclosure of technical details. Consequently, they can improve the spread of innovations, fortify ecosystems, and possibly inspire further innovation. As demonstrated by Brown et al. (2022) for hydrogen, graphene, synthetic biology, and quantum computing, standards can be more effective in fostering innovation than public regulation, especially in emerging technologies (Blind et al., 2017). Furthermore, through reference to public procurement, standards can facilitate the diffusion of innovation within the public sector in addition to their role in the private sector (Blind, 2008). Different stakeholders from science, technology, and markets collaborate in standards-setting organisations' processes (Baron et al., 2019) to reach an agreement on guidelines for emerging technologies. Stakeholders, which include the public, manufacturers, technology providers, researchers, and service providers, represent the supply side. Producers situated further down the value chain are eager to incorporate their preferences into standards pertaining to parts, goods, and even services, which they could subsequently incorporate into their own more intricate systems or products. In fact, the new standardisation strategy of the European Commission, which was introduced in 2022 (European Commission, 2022), seems to indicate a growing intention to hand over control to the regulator, in part because it seeks to "promote EU core values", including sustainability in international standardisation. The European Commission wanted to review current standards to bring them into compliance with the "European Green Deal," in addition to concentrating on encouraging the development of standards for priority topics (such as clean hydrogen, low-carbon cement) and overarching initiatives (Ecodesign, Sustainable Products Initiative). Such sustainability-related extensions of mission-oriented policy into standardisation seemed to be supported by the general consensus among stakeholders. Formal standardisation provides platforms and processes that are well-established, giving its regulations credibility and causing them to spread widely. Formal standardisation has the potential to act as an intermediary and guide industrial sustainability beyond the direct actors involved, due to its close relationship to

public regulation. Formal standards that actively took into account the SDGs might cause industries that have not previously placed much emphasis on sustainability to become more sustainable as a result of integrating the interests and knowledge of various stakeholders and advancing the mainstreaming of sustainable technologies and practices.

According to Blind and Mangelsdorf (2016), standardisation is an example of this tactic, where businesses utilise their involvement to fully thwart undesired (public) regulation or use standards to sway concrete implementations in favour of their objectives. Moreover, Flynn and colleagues (2019) highlight the significance of the UK's liberal environmental governance in comparison to China's authoritarian counterpart when it comes to standards in the Circular Economy. This is a question that Polverini (2021) has recently brought up for the European Union. Schaltegger et al. (2019) in particular pointed out that these business cases ought to be predicated mostly on the voluntary efforts of a wide range of stakeholders to resolve social or environmental issues. They ought to go beyond merely adhering to laws and regulations, which are incapable of anticipating the incentives and costs associated with compliance from all pertinent parties. They explained that the framework conditions that affect social and environmental activities, such as laws and other institutions are made by the stakeholders themselves. Specifically, they highlighted how businesses could influence co- and self-regulatory guidelines in stakeholder relations. This was reinforced by Montiel et al.'s (2021) assertion that market-driven standards might assist businesses in minimising potential regulatory penalties.

According to Jansen et al. (2011) and Liberman-Yaconi et al. (2010), the two distinct internal factors are pressure to expand and internal social networks. Social and entrepreneurial networks, as well as family or founding members, are examples of internal social networks (Jansen et al. 2011; Liberman-Yaconi et al. 2010). These networks are an input source that affects SDM (Liberman-Yaconi et al. 2010). Joint SDM, or the adoption of new SDM decision procedures, may result from pressure to expand. The first item on the list of influencing factors was infrastructure. It consists of physical structure (the actual workspace and its functionality), staffing (the number of employees), and hierarchical (the organisational structure) (Gopaul 2019). The workspace itself was distinctive (Gopaul & Rampersad 2020). Second, in the South African context, finance was recognised as an internal factor even though it was identified as an external factor (Gopaul & Rampersad 2020). Thirdly, in the

South African context, organisational culture made a distinctive contribution to the SDM in SMME literature.

External networks are one type of unique external factor (Forbes 2005; Liberman-Yaconi et al. 2010). The use of strategic networks, through which SMMEs cooperate, was also noted (Wegner & Mozzato 2019). Additionally noted were influences originating from the franchise context, technological dynamics, and outside funding (Jocumsen 2004) (Croonen & Brand 2009). Although a wider body of research indicated that environmental factors affect SDM, financial and technological factors appear to have a greater impact on SDM in small and medium-sized enterprises. The literature on SMMEs also identified decision-specific factors, though there hasn't been as much research on SMMEs. These variables comprise the actual strategic decision (Jocumsen 2004; Mitchell et al. 2011) as well as the situation surrounding the decision (Fiegener 2005). The fact that social networks, particular managerial traits and the dynamics about the type of enterprise (e.g., family business and entrepreneurship), decision-specific factors, and pressure to grow were not explicitly highlighted is another intriguing finding regarding SDM in South African SMMEs (Gopaul & Rampersad 2020). The study found that risk, uncertainties, or challenges that must be taken into account when making strategic decisions are influencing factors against decision making; Operations, which is the term for the SMME's functioning that must be taken into account when making strategic decisions and helps the decision-maker determine whether a strategic decision (i.e., the decision to pursue the strategic decisions) can be implemented; constraints and/or opportunities that show both good and bad aspects and particularly draw attention to time and capacity and Limitations and/or opportunities help the decision-maker determine whether a strategic choice can be carried out in the first place. Rewards stand for results, or, returns for both the decision-maker and owner in SDM and the SMME.

According to Bachmann, Ligon, and Skerritt (2022), financial incentives that are both specific and generous could be effective in promoting and maintaining a swift improvement in performance. When it comes to maximizing the benefits of a transformation, seven principles can help. When it comes to the role that local governments play in economic development policy, cities vary greatly from one another. They have distinct roles in the national economy, specialize in various fields, have workforces with varying skill sets, are served by various infrastructures, and possess various natural resources. For economic development policies to be effective, they must be customised to the specific needs of each

city and implemented at all governmental levels. In Africa, local governments are the major key players in economic development. To boost economic growth, they should ideally pursue local economic development policies and have a major role in the execution of national economic development programmes. Local policies, on the other hand, frequently focus more on service delivery than on economic development. The importance of local governments in carrying out national economic policy is also sometimes overlooked by national governments. Accelerating and enhancing the quality of economic growth in Africa requires both increasing decentralisation and building local government capacity. African local governments still have limited fiscal and administrative capacity, even in spite of significant decentralisation efforts in recent decades. Many local governments are underfunded and lack the trained personnel necessary to implement efficient economic development initiatives. This has a negative impact on productivity, revenue mobilisation, investments, and the city's appeal to foreign investors. Both the local and national levels are affected by the repercussions. Since 2000, the proportion of Africans living in cities has increased by 4.7% yearly. Cities are growing into the purview of nearby local governments due to this rapid growth, and they are also becoming more and more divided. It is challenging to develop cogent policies in urban areas due to the multiplicity of local government jurisdictions, which results in coordination gaps between local governments. Sprawl, congestion brought on by ineffective transport networks, and decreased productivity are some of the detrimental effects. To coordinate policies among local governments in an urban area, metropolitan governance arrangements are required. For example, dedicated metropolitan authorities may be better suited to build administrative capacity for specialised jobs like complex infrastructure planning and the delivery of utilities and public services.

Coordination of policies across sectors and long-term policy consistency is ensured by effective strategic planning. Establishing shared goals among interested parties and deciding on policy measures to accomplish these goals are beneficial. Still, not every strategic plan works. One of the main causes of the failure to execute strategic plans is unfunded commitments. For this reason, it is essential to link the process of making financial decisions with strategic planning. Beyond just producing plans, strategic planning has other benefits. Administrations and outside stakeholders can learn about successful policies to boost the local economy through the planning process. Both the public and private sectors could gain capacity as a result. Administrations should strive to carry out internal strategic planning to

realize these benefits. there must be a balance of Policies for local economic development. In addition to being tailored to the local environment, they must be in line with the priorities of national economic policy. While creating local economic development policies, it is helpful to keep in mind five fundamental principles, as it is impossible to provide a blueprint for strategies that work in every situation. Combined policy packages work better than separate projects. Effective local economic development policies take into account a variety of factors and work to guarantee that the prerequisites are met for the growth of economic activity. Since isolated policy initiatives seldom can eliminate every obstacle preventing economic development they frequently fail (Gopaul & Rampersad 2020).

A key component of local economic development policy is locating and leveraging a city's competitive advantages. For cities that are struggling economically, it is especially crucial. Cities must recognise the qualities that set them apart from their rivals and incorporate these qualities into their economic development strategies in order to draw in business. Advantages could frequently be gained from synergies and complementarities with nearby cities. Cities should therefore take into account their unique strengths and weaknesses as well as their position within a larger regional and national framework. For small and medium-sized cities that lack the economic mass to support several major industries, it is particularly crucial. Not all forms of specialisation, though, support economic growth. For the purpose of economic development, it is especially crucial to specialise in activities that add value to the local economy. More economic diversification at the federal level is facilitated by cities that create unique economic identities. Spatially uniform economic diversity is not exhibited by the majority of diversified national economies. Many cities with distinct specialisations are usually included, contributing to a diversified national economy (Channell, 2023)

Bachmann, Ligon, and Skerritt (2022) report indicated that establishing a shared understanding of the current state of affairs, defining goals that all parties involved could agree upon, and formulating a plan of action for reaching those goals are the three main goals of strategic planning. Instead of being a top-down process where a local government presents a strategy without giving other stakeholders an opportunity to influence it, strategic planning need to be a collaborative process where all stakeholders are represented in order to fulfil these functions. Those involved in the informal economy, which are crucial to the economies of African cities but are frequently marginalised in the policy-making process, should be given a sufficient voice. The range of policies that local governments are responsible for

overseeing determines what policies local strategic planning should address. Land-use planning and transport policies are frequently two of the most significant policies that are included in strategic plans. It should come as no surprise that metropolitan authorities are frequently in charge of strategic planning, which they use to coordinate policies among various local governments (OECD, 2015). But other policies, like those pertaining to skills and regulations, might be just as significant. In addition to helping various actors coordinate their policies, strategic planning is necessary to guarantee the continuity of policies over time. It takes years for many economic development policies to start showing results. When a city decides to strategically support economic growth in a particular industry, it might construct an industrial park, build new training programmes in partnership with technical colleges, invest in targeted infrastructure, and launch focused marketing campaigns to draw in foreign direct investment. Such policies could be put into effect all at once, and one-time projects are probably not going to succeed. The consistency of policy required to implement advanced local development policies is ensured by a strategic plan that directs policy for a minimum of five to ten years. There is an inherent benefit to using strategic planning to direct future policies, as it facilitates business planning. One of the most crucial aspects in business investment decisions is frequently a stable policy environment. A company is more likely to invest in a new regional headquarters if it is aware that the site is connected to a public transport system that would expand over time. This assurance could be given by a well-executed strategic plan that directs infrastructure development over a long period of time. Nonetheless, local governments frequently depend mostly on their convocation power. They might organise hearings and consultations, create forums for discussion amongst actors (like roundtables), and use their connections to put actors in touch with one another. The coordination of policies is, crucially, a two-way process. It might also mean that local governments modify their programmes to better fit the needs of other stakeholders. When creating policies, local governments should frequently consult stakeholders and make adjustments based on the input gathered during the consultation process.

Given that most policies could only be implemented with adequate funding, strategic planning and fiscal decisions must always be closely aligned (OECD, 2019). One of the main causes of strategic plans' failure is unfunded commitments. To ensure that funding decisions and strategic planning are in place, there must be a connection between the two processes of strategic planning and fiscal decision-making. Strategic plans need to take the political priorities of the major funders into account, since major funding decisions are invariably

political in nature. It is unlikely that funding decisions could align with strategic plans unless they take this action. Remember that the goal of strategic planning is not to take the place of government political decision-making. Rather, its goal is to identify workable ways to put government policy priorities into action and synchronise them with the goals of other stakeholders.

According to Díaz-López et al. (2021), financial drivers are the most relevant and have the highest degree of consensus, demonstrating the ability of financial subsidies to promote the development of sustainable buildings. China's construction of sustainable buildings could be explained by the country's unique economic fundamentals and incentive policies that rely on subsidies. Additionally, the European Investment Bank is actively funding sustainable housing and affordable housing. Similarly, sustainable buildings are preferred by banks because their costs could be amortised over the course of the building, making loan repayment easier. Thus, both owners and occupants of sustainable housing could benefit from lower life cycle costs. In addition, they rent or sell more quickly, resulting in larger profits. As a result, these findings support and extend the conclusions of earlier studies and analyses of experiences in other nations. Furthermore, according to the respondents, these results imply that the financial effort required in implementing sustainability criteria in housing might be offset by the benefits of policies adopted by both public and private entities. As a result, the findings lend credence to the desire to further explore the connection between financial driver investment and the advantages that result from it, in order to create governance models that encourage sustainable construction.

According to Blind and Heß (2023), achieving the Sustainable Development Goals (SDGs) of the UN could benefit from both voluntary standards established through co-or self-regulatory processes and governmental regulation. Following the UN General Assembly's adoption of the Sustainable Development Goals (SDGs) in 2016, it became evident that achieving the goals would require strong support from a wide range of stakeholders who must collaborate. To accomplish the goals, companies and civil society organisations must support not only national and local governments but also international organisations that initiate policies and set regulations (OECD, 2021). Through standardisation, discursive, and even institutional effects, or direct normative changes on self- or co-regulatory levels through standardisation, more ambitious involvement from economic actors in translating the goals into concrete industry objectives and implementations might increase the SDGs' transformative impact

(Biermann et al., 2022). According to Montiel et al. (2021), the 17 SDGs are divided into six major categories based on whether they help businesses—especially multinational corporations—create positive externalities linked to wealth, knowledge, and health or lessen negative externalities related to overuse of natural resources, disruption of social cohesion, or excessive consumption.

2.4.1. Necessity for Corporate Sustainability

Sharma (2002) believes that corporate sustainability is crucial because it encourages businesses to adopt more environmentally friendly practices and consider factors other than just their bottom line. This is especially important because only 100 companies account for more than 70% of emissions, necessitating greater corporate responsibility than is currently being shown, the study reveals. These days, developing environmental impact and raising profits are complementary strategic objectives rather than opposing ones. Organizational practices have been revolutionized by the increased global consciousness of environmental impacts and the growing importance of social responsibility. An organization can incorporate ESG considerations into its corporate culture, decision-making processes, and operations by developing a comprehensive and goal-oriented plan known as a sustainability strategy. This strategy's primary goal is to make the company's goals and practices consistent with sustainability principles. A sustainability strategy encompasses more than just one-off acts or focused projects aimed at environmental or social responsibility. With the goal of generating long-term value for the business and society, it incorporates sustainability principles into the fundamental business operations. This entails taking into account the impact that the company's operations have on matters like business ethics, transparency, diversity and inclusion, human rights, climate change, and the use of natural resources. A well-executed sustainability plan reduces risks, fosters innovation, growth, and talent attraction and retention while enhancing reputation and brand value. Sustainability must be ingrained in the company's culture at all levels of operation, including top management, in order to guarantee its efficacy, the report advised.

According to Morrison (2021), businesses need a sustainability strategy for a number of reasons that go beyond the advantages for the environment and society. Businesses can benefit greatly on a number of fronts by taking into account ESG (Environmental, Social, and Governance) considerations and putting a sustainable strategy into practice: By encouraging

resource efficiency, ESG strategies directly cut costs. Employing sustainable practices can help businesses save operating costs and improve their financial performance. Examples of these practices include cutting back on energy and water use, optimizing the use of raw materials, and improving logistics. A study by Brock (2023) indicated that customer preferences are influenced by ESG factors. Sales of sustainable goods and services may rise as a result of consumer preference. Additionally, because they are viewed as having less risk, financial institutions frequently offer favourable conditions to companies with high ESG scores. Innovation in organizations can be stimulated by sustainability. Requirements to operate sustainably push businesses to look for creative ways to solve problems that have less of an impact on the environment, like creating recyclable materials, cutting waste, and implementing cleaner technologies. Morrison (2021) added that employing an ESG strategy can assist businesses in finding and keeping talented employees. Workers, particularly in the younger generation, are drawn to organizations that care about sustainability and look for jobs with a purpose. Productivity and job satisfaction can both rise with a compelling ESG value proposition. ESG provides a thorough method of managing risks. Companies can lessen the risk of penalties, legal action, and reputational harm by implementing standards for worker safety, environmental management, human rights, and compliance with laws and regulations. Robust ESG policies are also viewed by investors as signs of efficient risk management. A sustainable strategy benefits communities and the health of the planet. It provides observable improvements in productivity, company expansion, creativity, attracting top talent, lowering risk, and financial performance. This strategy promotes long-term, sustainable business success and is consistent with contemporary values, the author says.

Eunsup (2014) believed that the benefits of corporate sustainability for the environment, biodiversity, and climate change are numerous and easily understood. It's reasonable to argue that there is an excessive amount of environmental concern. In order to fight climate change, businesses and facilities are searching for creative ways to lower their carbon footprints. A company that practices sustainability seeks to alter customary actions in order to lower greenhouse gas emissions that persistently impact the environment. In terms of biodiversity, companies that prioritize sustainability can create more jobs in the forestry, agriculture, fisheries, and other fields that preserve the diversity of living things. Being conscious of the environment plays a big role in the expansion and success of businesses. Companies that practice sustainability tend to attract investors who share their values and goals. Corporate sustainability fosters customer-business relationships, which in turn increases consumer

desire to use goods and services. Companies can grow by gaining the public's trust by aligning with customer values (Bachmann, Ligon, and Skerritt, 2022).

Pandey (2023) asserted that the phrase "corporate sustainability" is more than just a marketing gimmick for companies looking good. Leaders are starting to realize that it is now essential to the industry's and the ecosystem's survival. To put it simply, it's the process of managing a company with an eye toward the present while setting aside money for the future. Stated differently, it examines how businesses can contribute to a healthier environment. Eunsup (2014) added that business operations that adhere to environmental, social, and economic considerations are guaranteed by corporate sustainability, a subset of Environment, Social, and Governance (ESG) practices. Among other things, they accomplish this by implementing sustainable business practices, employing renewable energy sources, and implementing ethical waste management techniques. Additionally, it considers how a business affects its stakeholders, workers, clients, community, and environment.

A company that practices corporate sustainability can reap many benefits. Among them are:

● Lessen detrimental effects on the environment: Corporate sustainability uses sustainable business practices, resource preservation, and industrial waste reduction to reduce its negative effects on the environment. ● Encouraging businesses to be socially responsible: Businesses have an obligation to their clients and the community in which they do business, among other stakeholders. By reducing waste and using resources wisely, corporate sustainability makes businesses socially accountable. • Cuts expenses: Corporate sustainability helps businesses cut waste and boost productivity. This may contribute to lower operating expenses. ● Win over customers: Consumers are choosing environmentally friendly brands as a result of their growing environmental concern, Bachmann, Ligon, and Skerritt (2022) revealed.

Even though some organizations set high standards for net-zero emissions and de-carbonization, they eventually fall short of their objectives. Companies that successfully accomplish their sustainability goals need to educate important stakeholders about the significance of corporate sustainability. These stakeholders include:

● Aligning businesses and sectors with sustainable development norms is the fundamental purpose of corporate sustainability. Creating a rough roadmap for a revitalized, eco-friendly, and cleaner earth is also essential in light of climate change and global warming.

● In the current era of heightened consciousness regarding social concerns and environmental well-being, corporate sustainability has emerged as a crucial instrument for persuading clients about the objectives and priorities of the enterprise. In summary, corporate sustainability is important because it helps businesses to expand, change, and reconsider in response to the requirements of a changing world and society, according to Bachmann, Ligon, and Skerritt (2022).

Corporate sustainability, according to Dr. Greenfield (2023), is the practice of conducting business while taking into consideration how a company's operations will affect society, the environment, and future generations. It extends beyond the conventional emphasis on increasing profits and shareholder value by taking into account the welfare of numerous stakeholders, such as workers, clients, suppliers, local communities, and the earth itself. The primary objective of corporate sustainability is to create long-term value for the organization and society while realizing how interdependent their interests are. In today's business world, corporate sustainability is also crucial because it acknowledges the interdependence of businesses, society, and the environment, going beyond conventional profit-driven strategies. Corporate sustainability is important because it can help solve urgent global issues, promote ethical business practices, and benefit different stakeholders. In order to solve the global issues of resource depletion, environmental degradation, and climate change, corporate sustainability is crucial. Businesses can lower their carbon footprint and help protect ecosystems and natural resources by implementing sustainable practices. Increasing client loyalty and brand reputation customers are becoming more conscious of how their purchases affect the environment and society. Companies that put sustainability first gain the confidence and allegiance of their clientele, which enhances their brand recognition and gives them a competitive edge. Businesses can increase their resilience to environmental, social, and economic challenges by implementing sustainability practices. By lowering resource dependence, diversifying supply chains, and making long-term risk plans, businesses can better withstand shocks and uncertainties. The imposition of sustainability-related rules and standards by governments and international organizations is growing. Businesses that adopt sustainability proactively maintain compliance, avert fines, and protect their brand. Companies are better able to handle risks related to the environment, society, and economy

when they incorporate sustainability into their strategies. Sustainability practices protect a company from potential harm by strengthening its ability to withstand crises and unanticipated events. According to Freeman (2010), businesses that embrace sustainability are more likely to implement cutting-edge procedures and technologies, which boost productivity and reduce expenses. Both new business opportunities and process improvements can come from sustainability. When making investment decisions, investors take environmental, social, and governance (ESG) factors into account. The study disclosed firms that adhere to robust sustainability standards draw conscientious investors and obtain funding at advantageous conditions.

Businesses, society, and the environment, according to Wen and Qiang (2022), can all benefit from corporate sustainability in different ways. Adopting sustainable practices is not just the right thing to do; it is also a strategic necessity that will benefit all parties involved in the long run. Corporate sustainability has many advantages and can add value in a variety of ways.

● Businesses that prioritize sustainability are able to stand out from the competition. By focusing on sustainable goods and services, these companies can draw in eco-aware customers and take advantage of growing markets. Studies have demonstrated that sustainable businesses outperform unsustainable ones financially over the long term, debunking the myth that sustainability impedes profitability. They are less vulnerable to supply chain interruptions and market swings and more resilient and adaptive.

● Workers are looking for jobs that are more meaningful and in line with their values. Businesses that demonstrate a commitment to sustainability and draw in top talent tend to have higher rates of employee retention. Oyewole, Komolafe & Gbadegesin (2023) added that long-term success depends on developing trust with all of your stakeholders, including consumers, investors, and communities. Stakeholder trust is increased by corporate sustainability, which promotes accountability, transparency, and responsible decision-making. Businesses that prioritize sustainability work hard to innovate and create eco-friendly goods and procedures. It produces advantages over competitors and may lead to discoveries that advance society.

Scott (2023) asserts that the term "corporate sustainability" is now popular among both large and small businesses. The phrase "corporate sustainability" basically describes a way of

doing business that, through the pursuit of ethical environmental, social, and economic (or governance) strategies, creates long-term value for shareholders, employees, consumers, and society at large. Concern for corporate sustainability is growing among investors who want to achieve both social good and financial gain. Corporate sustainability is built upon three pillars: the ecological, the socially conscious, and the financially viable. Businesses can decrease their carbon footprint or wasteful practices, for example, to increase their environmental sustainability. The company's consumers, workers, and the larger community are all benefited by the practices represented by the social responsibility pillar. The economic pillar, also known as governance, deals with upholding integrity in accounting procedures and adhering to legal requirements. Environmental, social, and governance (ESG) practices, or the three pillars, are the general term for corporate sustainability practices. Businesses use ESG to lessen their impact on the environment or to achieve other goals that will benefit society. One common definition of corporate sustainability is "fulfilling current needs without compromising the ability of future generations to fulfil theirs, the study indicated.

The three primary pillars of sustainability are the economy, social responsibility, and the environment. (These four pillars are also known as people, planet, purpose, and profits informally.) It's helpful to know the phrases that are occasionally used in place of the three pillars. "People" means being conscious of how operations and goods affect staff, clients, and the community at large. Planet refers to safeguarding our home planet and, if feasible, enhancing its current state. The reasons behind a company's actions and whether the mission still makes sense in light of the company's new, three-pillar priorities are related to its purpose. Companies are prompted by profit to evaluate the viability of their plans, strategies, and initiatives. Typically, the environmental pillar receives the greatest attention. In addition to the environment, the economy will also benefit from this action. For example, cutting back on the packaging materials, can save money and increase fuel economy. Scott (2023) believed that a problem with the environmental pillar is that businesses' effects are frequently undervalued. This indicates that some externalities exist that the prices of consumers do not account for. Since businesses aren't always responsible for the waste they produce, it can be difficult to determine the total costs of wastewater treatment, carbon dioxide emissions, land reclamation, and waste in general. The goal of benchmarking is to measure these externalities to track and report on their reduction in a meaningful manner.

Scott (2023) maintained that in the community in which a sustainable business operates, stakeholders, and employees should all support and approve of it. The methods for obtaining and preserving this kind of support differ, but they all boil down to treating workers fairly and acting as a good neighbor and members of the community on a local and worldwide scale. Businesses can put more of an emphasis on employee engagement and retention tactics. Better maternity and family benefits, flexible scheduling, and chances for professional growth are a few examples of more adaptable benefits. Companies now engage in the community in a variety of ways, such as through fundraising, sponsorship, scholarships, and investments in regional public projects. A company must understand how its supply chain operates on a global social level. Does the production of goods involve the use of child labor? Do people receive fair compensation? Is the workplace secure? This has proven difficult for many big retailers in the face of public outrage over workplace accidents (like the factory collapse in Bangladesh) that can expose hidden hazards.

Zainab et al. (2013) were of the opinion that for most businesses, the economic pillar of sustainability is where things feel more stable. A profitable business is necessary for it to be sustainable. Profit, however, is not superior to the other two pillars. The economic pillar actually has nothing to do with profit at any cost. Although these practices are commonly implemented by the majority of North American businesses, they are not the norm worldwide. This pillar is sometimes referred to as the governance pillar (ESG for short). This speaks to boards of directors and management lining up with the interests of the company's customers, value chains, and community in addition to shareholders. For instance, investors might want to know that a business employs honest and open accounting practices and that shareholders have a say in significant decisions. They might also want guarantees that businesses don't participate in illicit activities, avoid conflicts of interest in their selection of board members, and don't use political contributions to get preferential treatment. Businesses are able to examine and approve sustainability strategies because of the economic pillar's inclusion and acceptance of profit. The economic pillar acts as a check on the extreme measures that companies are occasionally pressured to take, like giving up chemical fertilizers or fossil fuels all at once rather than gradually. The practice of corporations disclosing sustainability objectives and their advancement toward attainment on a regular basis is known as corporate sustainability reporting. This makes it easier for the general public to comprehend how a business is supporting a sustainable global economy. Information about the company's resource usage, the advantages and disadvantages of its

operations for the environment, and its plans to become more sustainable in the future are all possible topics for sustainability reports, the study said.

Long-term corporate profits as stated by Eunsup Daniel Shim (2014) can be advanced by sustainable practices, in addition to the social benefits of improving the community and environment. A company can gain goodwill by, for instance, implementing policies that benefit the community and its employees. They might also raise prospective clients' disposable income. The objective of corporate sustainability is to replace business practices that have the potential to harm the environment (both locally and globally), negatively impact society, and obscure a company's financial information and operational procedures with ones that benefit all parties involved in all three areas over the long term. A company's whole supply chain is included in sustainability, necessitating accountability starting at the top and extending to its suppliers and retailers. Some of the global supply chains that have grown dependent only on low-cost production may need to be reorganized if manufacturing sustainably becomes a competitive advantage for supplying multinational corporations and end users. That scenario, of course, depends on how much corporate sustainability is embraced and whether it is a real shift in direction or merely lip service.

According to Morrison, (2021, investors use the environmental, social, and governance metrics to assess the risk and sustainability of their real estate investments. These elements are: Environmental: concerns include those related to pollution, energy use, and global warming. Social factors include things like community outreach, health and safety concerns, and how an organization treats its employees. Governance: subjects covered include accounting, executive compensation guidelines, board independence and structure, and business ethics. Given that the three topics are presented as "including" issues "such as" those listed, even that seemingly succinct definition is extremely ambiguous. Even businesses that ESG authorities would likely to rate poorly have undoubtedly be measured and thought about these issues. That aligns with the overall ambiguity that permeates the "responsible" investment space. It turns out that creating policies and "considering" issues are the main tasks of a lot of the current ESG guidance.

Brown (2023) was of the opinion that for most businesses, the economic pillar of sustainability is where things feel more stable. A profitable business is necessary for it to be sustainable. Profit, however, is not superior to the other two pillars. The economic pillar has

nothing to do with profit at any cost. Although these practices are commonly implemented by the majority of North American businesses, they are not the norm worldwide. This pillar is sometimes referred to as the governance pillar (ESG for short). They might also want guarantees that businesses don't participate in illicit activities, avoid conflicts of interest in their selection of board members, and don't use political contributions to get preferential treatment. Businesses can examine and approve sustainability strategies because of the economic pillar's inclusion and acceptance of profit. The economic pillar acts as a check on the extreme measures that companies are occasionally pressured to take, like giving up chemical fertilizers or fossil fuels all at once rather than gradually. The practice of corporations disclosing sustainability objectives and their advancement toward attainment regularly is known as corporate sustainability reporting. This makes it easier for the general public to comprehend how a business is supporting a sustainable global economy. Information about the company's resource usage, the advantages and disadvantages of its operations for the environment, and its plans to become more sustainable in the future are all possible topics for sustainability reports, according to the Investopedia Team (2023).

Beattie (2023) discovered that sustainable methods can increase long-term corporate earnings while also providing social benefits to the community and environment. A corporation can build goodwill by, for example, enacting policies that benefit both the community and its employees. They may also increase prospective clients' disposable income. Corporate sustainability aims to replace business practices that have the potential to harm the environment (both locally and globally), have a negative impact on society, and obscure a company's financial information and operational procedures with those that benefit all parties involved in all three areas over time. Sustainability encompasses a company's entire supply chain, mandating accountability from the top down, including suppliers and retailers. According to the paper, some global supply chains that have become overly reliant on low-cost production may need to be restructured if manufacturing sustainably becomes a competitive advantage for supplying multinational firms and end users. That future, of course, is dependent on how much corporate sustainability is adopted and if it represents a genuine shift in direction or merely lip service.

2.5. Influence of regulatory bodies on the economic benefits

In addition to fiscal and monetary policy, regulation is one of the three main levers of state power and is crucial in determining the welfare of economies and society (OECD 2010).

Regulations and regulatory frameworks must serve the public interest, and regulatory policy seeks to make sure that this is the case. New ideas will be captured if the broadest range of stakeholders is included in the regulatory process (OECD 2010). Opportunities for innovation and start-up businesses that are innovative will be encouraged by reduced burdens and a more accurate economic analysis of new regulations.

Over the past thirty years, one significant development for public governance in the OECD (2010) and beyond has been the emergence of regulatory policies aimed at promoting better regulation. What role can efficient regulatory governance play in addressing the contemporary public policy issues that governments face, such as population ageing, unemployment, and climate change? How can societies and economies find the path to sustainable growth through regulatory policy? These are challenging issues that require careful consideration and debate. A serious test of the efficacy of regulatory policy has been the recent environmental disasters and financial crisis. Red tape is still being criticised by citizens and businesses for delaying progress and interfering with competition. When there is bureaucracy in government, public services are also impacted. Legislative clarity is still being weakened in many nations by regulatory inflation. The report seeks to provide a foundation for discussion on how regulatory policy can assist in addressing issues related to public policy. As nations emerge from the crisis, it promotes the need to "think big" about the applicability of regulatory policy in promoting growth and social welfare. With the completion of this report, the OECD and the European Commission have completed a significant project that involved assessments of the regulatory frameworks in fifteen EU member states over the previous two years. The results of the OECD (2010) reviews on other countries, both OECD and non-OECD, were integrated with the findings from these reviews. The report considers recent conceptual analyses on important issues by the OECD as well.

Diaz-Lopez et al. (2021) disclosed that further development of regulatory policy's fundamental institutions and processes is necessary if it is to foster economic and social renewal. In order to support policy coherence, this entails strengthening evidence-based impact assessments; building institutional capacities to determine and advance reform priorities; and, last but not least, giving users' voices more weight during the regulatory development process. "Effective regulatory governance is essential for success." Stronger regulatory governance, or closing the loop between regulatory design and outcome evaluation, is the only way to execute effective regulation that will assist governments in

meeting their difficulties. This calls attention to a number of issues, such as: ● institutional leadership and oversight; ● re-evaluating the role of regulatory agencies and striking a balance between public and private regulatory responsibilities in order to ensure accountability and prevent capture; ● placing a renewed emphasis on coordination, communication, and consultation at all levels of government and beyond, including the international sphere; and ● bolstering the public service's capacity for regulatory management. The study maintained that along with fiscal and monetary policy, regulation is one of the three main tools at the state's disposal that shape the welfare of economies and societies. Ensuring that the regulatory lever functions effectively and that laws and regulatory frameworks serve the public interest is the goal of regulatory policy. The relatively new field of regulatory policy is developing in various ways both within and outside of the OECD membership. On the other hand, divergent paths are generally heading in the same direction. Ensuring that regulations serve the public interest is the goal of regulatory policy. It tackles the ongoing requirement to guarantee that rules and frameworks for regulations are appropriate, well-made, and "fit for purpose." Regulatory policy, a crucial component of efficient public governance, influences how the government, people, and corporations interact. Informed decisions about what, who, and how to regulate are made easier by an efficient regulatory framework that promotes both economic growth and the rule of law. The report further stated that the assessment of regulatory outcomes provides policy makers with information about achievements, shortcomings, and the necessity of modifying regulations to ensure their continued effective support of public policy objectives.

Diaz-Lopez et al. (2021) disclosed that any tool used by governments, their affiliate organisations, and supranational organisations (like the EU or the WTO) to impose legally binding standards on individuals and corporations is referred to as a regulation. Thus, the term may refer to a broad variety of instruments, including standards, administrative procedures and decisions that carry out higher-level regulations (like the issuance of permits), Governments may assign regulatory authority to non-governmental or self-regulatory organisations in order for them to create regulations. Regulations cover more than just what the private sector does. They consist of the policies and guidelines that govern how public authorities, such as ministries and government agencies, conduct themselves internally. This implies that, although not meant to have legal force, administrative guidelines and circulars may, in fact, become legally binding. The majority of nations have a well-defined legal

hierarchy, with their constitution at the top. Typically, they stipulate that regulations at lower levels must not contradict with those at higher levels and that the former must receive their legitimacy from the latter. Regulatory policy is one of the three primary tools available to governments for controlling the economy and society, carrying out policy, and influencing behaviour, along with fiscal and monetary policy. Though this may seem overly theoretical to local regulatory managers, it only highlights a stark reality that emphasises the significance of regulatory policy and the necessity of placing it at the forefront of governmental priorities. The authors added that regulation may be given more consideration as a tool for state intervention in light of the significant post-crisis restraints on government spending and the public's opposition to higher taxes. Regulation requires careful management even though it can replace fiscal measures and even be a more effective option than direct taxation. De Wit (2016) says that the risk of shifting costs to the private sector is increased regulation. Overly hasty adoption of inappropriate regulations in response to events may increase unneeded burdens, stifle innovation, undermine open markets, and harm competition, the report revealed.

Based on OECD (2010) research, it is crucial to establish a connection between regulatory policy and the larger public governance framework. The OECD's work on governance, which aims to promote efficiency, legitimacy, accountability, transparency, and public trust in government, already includes regulatory policy as a major component. Effective regulatory policies support and enhance other facets of public governance, such as transparency and citizen participation, in addition to being dependent upon them. According to OECD research on the prerequisites for effective reform, advancing policy reforms depends on several essential components of effective regulatory governance, including: • Robust research and analysis are prerequisites for the design of policies. Leadership is essential, whether it comes from a person or an organisation tasked with implementing the change. Appropriate institutions are required to support the change from conception to completion (a lengthy process). The presentation of research must come from a reputable, impartial organisation that is respected by people of all political stripes. Establishing these kinds of institutions takes time because their reputation determines how effective they are. However, this pays off because their presence has improved the chances of reform in certain sectors. Originally, the rise of regulatory policy was a reaction to shifting public policies, particularly with regard to the OECD membership's economic goals. It was not originally referred to as regulatory policy, nor was it intended to be. In response to the fast expansion of regulation during the

majority of the 20th century and the growing realisation that the accumulation of this regulatory stock was detrimental to business, stifling entrepreneurship and innovation, it began as deregulation in the 1970s and 1980s. During this time, there were initial efforts to reduce bureaucracy and recognition that regulatory inflation, as it is currently known, could pose a significant issue. Deregulation evolved into regulatory reform in the 1980s and 1990s as a result of measures to boost market competition and roll back the frontiers of the state. The goal of regulatory reform was to liberalise important economic sectors that had previously been the domain of monopolies, frequently state-owned ones, like the telecommunications industry. This approach carried on the deregulatory trajectory.

Larsson, Kitti, and Tran (2013) maintained that a new regulatory framework that was appropriate for the new circumstances in these sectors had to be created when competition was introduced. Beyond the network sectors, regulatory reform expanded to include product market reforms and the liberalisation of professional services, ultimately serving as a crucial abutment to structural reforms. Independent regulatory organisations were created to oversee important facets of society and economies apart from the political system as free-market policies grew in popularity. Regulatory reform gave way to the concept of regulatory management in the first few years of this century, with welfare as the driving force. This process recognises the permanent nature of the task and the requirement that it might be applied universally, not just to particular sectors or issues. It was occasionally implied by the term "regulatory reform" that the regulatory framework could be perfected and that regulatory policy makers could then pack up and go home. It wasn't that easy. It became increasingly clear that regulation was one of the state's primary roles. For the regulation to be deemed "fit for purpose," proactive management is necessary.

Regulatory management, Diaz-Lopez et al. (2021), involved major efforts to streamline and simplify the regulatory stock in some OECD member countries, particularly those in Europe. The goal was to modernise and clarify the legal codes—groups of related laws—that form the foundation of the civil law systems that are widely used throughout Continental Europe and beyond. It also gradually became apparent that the application of regulatory tools and processes, like Regulatory Impact Assessment, and effective regulatory management could potentially help any public policy, not just specific issues. Improving general welfare—rather than merely serving special interests or corporate interests—is the goal. While many regulations have much broader effects, some have sector-specific implications. The

importance of laws and organisations that support the environment and social welfare, such as health and safety, has increased. During this time, regulatory organisations, instruments, and procedures underwent significant developments. For instance, even though many nations have found it difficult to implement, the idea of a central oversight body to promote the application of regulatory quality principles and important procedures like Regulatory Impact Assessment has gained traction. Following the adoption of the Lisbon Strategy for Growth and Jobs by the European Council of Ministers in 2000 and the release of the Mandelkern Report in 2001, the European Union took on the task of creating a regulatory policy early in this century. In October 2010, the European Commission unveiled a new plan for smart regulation. Plans to further raise the calibre and applicability of EU law are outlined in this. It will assess the effects of laws at every stage of the policy cycle, from their creation to their implementation and revision. To promote the use of smart regulation, the European Commission will collaborate with the Council, the European Parliament, and the member states. Additionally, the strategy aims to increase public participation in the regulatory process.

Blind and Heb (2023) noted that the Regulatory Policy Strategy recognised the need to improve the business regulatory environment in addition to other key challenges, such as boosting productivity growth to increase the competitiveness of the EU economy. Ministers of Public Administration established the 2001 Mandelkern Group with the goal of creating a logical plan to enhance the regulatory landscape in Europe. In the report, the Group made recommendations to the EU institutions and member states regarding impact assessment, consultation, simplification, organisational structures for better regulation, access to regulation, alternatives to regulation, and national implementation of EU legislation. Economic theory and regulatory policy Economics, along with political science, history, and law, has played a significant role in shaping regulatory policy. Economic theory advancements have both taught and benefitted regulatory policy. There has been a lot of discussion in the mainstream since the crisis about how countries' approaches to regulatory governance need to change. Experts have pointed out that there can be both market failure and state failure, which refers to the state's inability to meet goals for social welfare and healthy markets. The state is not flawless; it is composed of organisations and people who occasionally put their own interests ahead of the good of the whole. Self-interest can exist in bureaucracies. There are actual risks from benign neglect and regulatory capture. This suggests that the benefits of state intervention and the issues it raises need to be examined

more closely. The financial crisis of 2008–09 focused attention on these issues. Escalating curiosity about sustainable development and distributional equity Political economy's primary concern, according to David Ricardo (1815), is how wealth is distributed among the classes. Equity in distribution is a concern for many OECD nations. The claim is that economic management ought to be implemented with an eye towards optimising the well-being of the most marginalised people, taking into account the distributional effects of policy decisions, but not going so far as to obstruct general prosperity. This focus on social effects has also been linked to the need to prioritise environmental issues and the more general topic of sustainable development.

Regarding the adoption of green innovations, Shahzad et al. (2022) found that building companies are not required by law to implement green practices. Nonetheless, the majority of the construction companies concurred that the primary driver behind their involvement in green practices would be modifications to laws and regulations. The only way to accomplish that is if the government regulations state that this is something that must be done and if the Building Standards specify that this is something that must be done, and then people must comply. If the Building Standards specify that a new energy efficiency measure requires that x, y, or z must be performed, then absolutely people must follow their instructions. Generally speaking, the construction sector only moves when directed by law. The report also stated that "Legislation always works. The study found that if no one is going to buy it, occupy it, or understand it, there's no point in building to the extremely high standard. The report's findings highlight how little consideration small businesses, in particular, give to environmental regulations. According to the study, they don't give a damn about the environment because it hasn't always been a big deal to them. Very few rules are insurmountable or inconsequential to them, and so forth. Indeed, there is a challenge there, especially for small businesses. Action towards regulatory compliance is influenced by capability, including knowledge, skills, and money, in addition to motivation and the fear of penalties. Some of the small businesses don't know enough about environmental protection to care about environmental regulations, which makes them less conscious of how important it is to protect the environment.

However, Heintz and Wamelink (2015) believed that due to a lack of regulatory backing, certain environmental regulations have been perceived as being insufficient. Furthermore, their primary focus is on making a profit rather than environmental protection and related

regulations because they typically have limited resources, including financial resources. As a result, they wouldn't be concerned about any regulations that require voluntary compliance. Overall, the comments made by the representatives of building firms and industry experts have reinforced the conclusions of earlier research which suggested that regulatory pressure may have a significant impact on construction companies' decision to implement green practices. Construction companies will comply with requests once they are aware of the regulations they must follow. Nevertheless, according to the results of the study, regulations are currently not strict enough to draw in businesses and have a direct impact on them. The findings have brought to light the significant impact that regulators have in pushing people working in the construction industry to adopt more environmentally friendly practices. On this point, industry experts and representatives of building firms were in agreement. The majority of construction companies would not go above and beyond the bare minimum of regulatory requirements, so the current regulations are not strict enough to force them to adopt green practices. However, the study's data indicates that some construction companies may not be aware of any rules. While some of them believed that certain regulations had no bearing on their business operations, this illustrates their partial ignorance of current regulations. Regulators should therefore be aware that construction companies may choose to disregard procedural compliance. The best people to push construction companies to use green practices are the regulators who oversee specific business operations within the sector. The study's conclusions indicate that the majority of construction companies favoured following the bare minimum of regulations, especially those pertaining to the environment. Therefore, if the regulatory bodies hope to influence behaviour in a way that will lessen their impact on the environment, they may want to reconsider how strict the regulations are.

2.5.1. Strategies to be employed to encourage the use of innovative sustainable construction materials

Effective upper management, according to Duncan, Kingi, and Brunsdon (2018), is a key facilitator of change in the building and construction sector. While avoiding obstacles like dispersed leadership and inconsistent decision-making, group responsibility for change and improvement can offer consistency of vision and desire for change. Additionally, clients can lead change as well as professionals in the sector. According to Farmer (2016), until there is a demand from customers, the building and construction business won't change. Therefore,

encouraging a new generation of workers who have grown up in a digital world could act as a strong stimulus for the sector to adopt new practices and boost productivity (Farmer, 2016).

Duncan, Kingi, and Brunsdon (2018), added that a company's decision to integrate environmental sustainability into its operations can have a range of effects on stakeholders. While still having a voice in the company's future, stakeholders ought to support its commitment to environmental sustainability. Stakeholders can be largely positively impacted by the growing awareness of sustainability among businesses as a result of public convictions and stricter environmental regulations. Even small businesses should review the concepts of sustainability and stakeholder management for several reasons. The study further stated that the word "stakeholders" refers to a broad range of individuals. Customers, shareholders, staff members, and communities with a stake in a company's development plans and strategies are considered stakeholders. A company's sustainability efforts impact each of these people, and they also have an impact on the global environment and society at large. Stakeholders in business increasingly include people living in developing nations due to the growing connections between the sector and the global economy. Since environmentally friendly practices improve water quality and natural resource reserves, these people are ultimately impacted by the business strategies and sustainability initiatives of multinational corporations. For various reasons, the government is a tangential stakeholder in businesses as well. Companies operating within their jurisdictions provide them with taxes. To make sure that companies abide by national regulations, they have to spend money. Businesses based in a country must be considered when signing environmental treaties that commit to lowering carbon emissions.

According to Meena et al. (2022), the research findings indicate that there is a growing trend among businesses to implement strategies that encompass not only the fundamental requirements of their operations and enterprise but also adhere to environmental regulations and acknowledge the significance of sustainability in safeguarding natural resources and ensuring human survival. The report also mentioned that knowing who to speak with, and their needs, interests, and motivations are the first step toward providing effective stakeholder education. Diverse stakeholders may exhibit varying degrees of consciousness, expertise, and involvement with regards to sustainability concerns. Additionally, they may react disparately to distinct forms of communication and information. For instance, investors might be more worried about how sustainability performance impacts financial performance and risk

management, whereas customers might be more interested in how goods or services help them save money. As a result, approaches and messaging must be modified to fit the target audience and make use of relatable language and examples.

Stakeholder education also requires back up to sustainability goals and claims with data and proof. If stakeholders cannot relate sustainability to their own circumstances, or if they consider it to be a compliance burden or a marketing gimmick, they may be sceptical or uninterested in it. As a result, it is necessary to support every claims with reliable data, figures, case studies, testimonies, or endorsements from outside parties that show how sustainability benefits the company and its stakeholders. It is also necessary to demonstrate how sustainability efforts have, for instance, lessened the impact on the environment, increased the effectiveness of operations, improved reputation, or generated new opportunities and value for the stakeholders. Engaging stakeholders and involving them in sustainability journey is the third tip for educating stakeholders about sustainability. If stakeholders perceive that they have a say in sustainability efforts and that their involvement will benefit them, they are more likely to learn from the efforts and alter their attitudes and behaviours. As such, avenues and venues for stakeholder input, communication, cooperation, and acknowledgment must be established. Stakeholders can be asked to participate in the sustainability committees, surveys, workshops, or events, for instance. Progress and challenges can also be shared with them, celebrate the milestones and accomplishments, and thank them for their contributions and best practices (Goh, Su, & Rowlinson, 2023). The study further indicated that motivating and enabling stakeholders to take initiative and change the world is the last piece of advice for educating them about sustainability. Stakeholders may be interested in and aware of sustainability, but they may not know how to apply it in their particular situation or may run into obstacles or opposition to change. As a result, advice, resources, tools, and incentives they need to get past the challenges must be given to them. Sustainable solutions in their own spheres of influence, is vital. To help stakeholders measure and improve their sustainability performance, provide them with checklists, templates, or calculators; also offer them online courses, coaching, mentoring, or training on sustainability-related topics; and recognise, thank, or even donate to them for their sustainability-related actions, the report maintained.

In any industry, including the construction sector, innovation is essential to advancing the state of affairs and maintaining competitiveness. Building companies must encourage an innovative culture in their projects because of the speed at which technology is developing

and the evolving needs of their clientele. By establishing an innovative culture in construction projects, construction companies can increase productivity and efficiency while also producing higher-quality projects by adopting innovative solutions and fostering creative thinking. In order to accomplish this, the significance of fostering an innovative culture in construction projects as well as the primary tactics that must be employed was discussed (Enayat et al., 2020).

Innovation is required in the construction industry, according to Outram (2024). The construction sector has long faced criticism for its sluggish adoption of new procedures and technologies. But now more than ever, innovation is needed in construction projects. Here are a few main justifications:

• **Growing Complexity:** With multiple stakeholders and intricate designs, construction projects are getting more complex these days. These intricacies can be simplified with the aid of innovation, ensuring smooth teamwork.

• **Cost and Time-Effectiveness:** Conventional building techniques frequently result in cost overruns and delays. Construction innovation can result in shorter construction schedules and lower construction costs by introducing new methods, supplies, and machinery.

• **Quality and Sustainability:** Using cutting-edge techniques can produce buildings that are not just strong and secure but also ecologically friendly and sustainable.

• **Techniques for Promoting Innovation:** At every level of a construction company, deliberate efforts are needed to create an innovative culture. The following are some methods to encourage creativity in building projects:

• **Commitment and Support from Leadership:** It is imperative that leaders in the construction industry show that they value and are committed to innovation. They should assign resources, define clear goals, and give staff members the freedom to experiment and think creatively. Leaders who support innovation can encourage their teams to adopt novel concepts and methods.

• **Cooperation and Teams with Various Functions:** An atmosphere that values diversity of thought and cooperation fosters innovation. It is recommended that construction companies form cross-functional teams comprised of professionals from various backgrounds, including engineers, architects, and contractors, who collaborate to solve problems and create creative solutions. This interdisciplinary approach can produce innovative concepts and better project results.

• **Adopt Digital and Technology Solutions:** Significant technological advancements have been made in the construction industry, including cloud collaboration platforms, drones, virtual reality, and Building Information Modelling (BIM). Adopting these technologies can facilitate real-time project monitoring and analysis, improve communication, and streamline workflows. Construction companies can increase project efficiency and make well-informed decisions by utilising technology.

• **Promote a Culture of Learning:** An atmosphere that promotes lifelong learning fosters innovation. Building firms ought to spend money on seminars and training courses that provide staff members the know-how and abilities to use creative thinking. Establishing forums for exchanging best practices and lessons discovered can also encourage more creativity by facilitating the flow of ideas.

• **Promote and Honour Innovation:** Construction companies should actively promote and reward innovative thinking in order to genuinely cultivate an innovative culture. Opportunities for career advancement, financial incentives, and recognition programmes can all help achieve this. Organisations can inspire staff to come up with and carry out original solutions by praising and recognising creative ideas.

• **Important Lessons:** Several advantages can result from fostering an innovative culture in building projects, such as increased productivity, affordability, sustainability, and quality. In order to do this, building companies ought to: • Acknowledge that innovation is necessary in an increasingly complex sector. • Ensure that the leadership is committed to promoting innovation. • Encourage cooperation and cross-functional teams to accommodate a range of viewpoints. • Adopt digital solutions and technology to streamline procedures. • Establish a culture of learning that promotes ongoing development. • To inspire staff, reward and encourage creative thinking. Construction companies can embrace innovation and prosper in a constantly changing industry by implementing these strategies. Fostering an innovative culture is advantageous for individual projects as well as for the construction industry's long-term success and expansion. • Encouraging Cooperation and Communication in Innovative Construction Projects, Outram (2024) noted.

Outram (2024) believed that teams that collaborate effectively can work together harmoniously, exchanging ideas, resolving problems, and completing projects on schedule and within budget. This article examines the significance of encouraging cooperation and communication in innovative building projects and provides insightful advice on how to make it happen:

• **The Significance of Collaboration:** innovations in construction projects that are successful are built on collaboration. Diverse teams comprising architects, engineers, contractors, and clients are brought together for projects that benefit from an integrated approach that guarantees the integration of different viewpoints, abilities, and expertise. The following are some major benefits of encouraging cooperation in construction projects:

• **Increased Efficiency:** Cooperation speeds up decision-making and cuts down on delays, ensuring that projects move forward smoothly and effectively.

• **Improved Problem Solving:** Teams are better equipped to recognise and address possible problems in collaborative settings, which encourage innovative solutions to challenging problems.

• **Optimised Resource Allocation:** Through teamwork, groups can combine their resources in an effective manner, making the most use of tools, supplies, and labour to achieve better project results.

• **Greater Innovation:** Combining the knowledge and experience of various professionals encourages innovation, which in turn leads to the creation and application of cutting-edge building methods and technologies.

• **Communication Is Essential:** In construction projects, successful collaboration is largely dependent on effective communication. Teams can reduce risks, stay on the same page, and make sure that all project stakeholders are working towards the same objective by communicating clearly and promptly. Important facets of communication that improve teamwork include:

• **Consistent Project Meetings:** Setting up frequent in-person and virtual project meetings keeps the whole team informed about developments, obstacles, and deadlines. These gatherings promote candid communication, empowering groups to discuss problems and reach defensible conclusions as a unit.

• **Real-time Collaboration Tools:** Teams can work together productively regardless of where they are physically located when they use technology. Teams may share files, monitor progress, and communicate in real-time by using tools like video conferencing and cloud-based project management platforms. This improves teamwork and closes communication gaps.

• **Transparent Documentation:** Successful cooperation depends on maintaining transparent documentation. Potential miscommunications and confrontations can be reduced by making sure that project details, schedules, and modifications are precisely recorded and available to all team participants.

• **Active Listening:** Good communication is a two-way street, and one important ability that promotes cooperation is active listening. It fosters an inclusive environment where everyone feels valued and can contribute to the project's success by listening intently to the ideas and concerns of other team members.

• **Overcoming Obstacles to Collaboration:** Although cooperation has many advantages, there are drawbacks as well. Typical obstacles and strategies for overcoming them include:

• **Geographic Dispersity:** Teams working on construction projects are frequently dispersed over several sites. Purchasing technology that facilitates remote collaboration, such as virtual reality for on-site visualisation, project management software, and video conferencing tools, is necessary to overcome this obstacle.

• **Interdisciplinary Communication:** Professionals from a variety of disciplines, each with their own specialised vocabulary and technicalities, work together on construction projects. Effective team collaboration is achieved through fostering interdisciplinary communication, dismantling organisational silos, and fostering knowledge sharing.

• **Language and Cultural Barriers**: In international construction projects, communication can be hampered by cultural and linguistic barriers. Establishing clear channels for communication and understanding, using language translation tools, and cultural sensitivity are all necessary to meet this challenge.

• **Important Lessons:** Bringing together a variety of expertise, improving efficiency, problem-solving, resource allocation, and stimulating innovation are all made possible through collaboration, which is essential for successful construction project innovations.

• Teams can only successfully collaborate if they communicate effectively, which allows them to work together to accomplish project objectives.

• **Effective communication** and collaboration require regular project meetings, real-time collaboration tools, transparent documentation and active listening. To surmount obstacles such as geographical dispersion, interdisciplinary communication, and language and cultural barriers, technological investment, knowledge-sharing, and cultural sensitivity are necessary. To sum up, encouraging cooperation and communication in innovative construction projects is essential to guaranteeing favourable results. Construction projects can become more efficient, more creative, more adept at solving problems, and more resource-efficient by embracing collaborative environments, implementing efficient communication techniques, and overcoming inherent obstacles. In the construction industry, a better future is possible by embracing cooperation and communication.

• **Using New Technologies to Increase Construction Management Efficiency:** These technologies not only simplify procedures but also increase productivity, lower expenses, and improve teamwork. A few of these cutting-edge technologies are examined in this article along with how they might change construction management.

• **BIM, or building information modelling:** building information modelling, is a potent technology that makes it possible to create and manage digital representations of the functional and physical aspects of construction projects. BIM makes it easier for stakeholders to collaborate on decisions and gives them a complete picture of the project at every stage of its life.

● **Using Sustainable Building Techniques:** The environmental effects of the construction sector are well-known. It generates a lot of waste, uses a lot of resources, and adds to greenhouse gas emissions. Nearly 40% of the world's energy-related carbon dioxide emissions come from the built environment, according to the World Green Building Council. These figures demonstrate how important it is to use sustainable building techniques in order to reduce environmental harm and meet long-term sustainability objectives.

Advantages of Using Sustainable Practices

There are several advantages to integrating sustainable practices into construction project management, such as:

• **Lessened impact on the environment:** Using sustainable practices helps to preserve natural resources, cut down on waste production, and cut down on carbon emissions. This is good for the environment and enhances the building sector's reputation as a whole.

• **Cost savings:** Over time, sustainable practices frequently result in cost savings. For example, energy-efficient buildings have lower running costs, which translate into lower energy bills.

• **Adherence to regulations:** Nowadays, a lot of nations have strict environmental laws in place. Construction companies can guarantee compliance with these regulations and avert penalties by implementing sustainable practices.

• **Enhanced engagement with stakeholders:** Using sustainable practices can draw in clients, investors, and staff who respect sustainable development and are environmentally conscious. Better business opportunities and collaborations may result from this.

In order to enhance sustainability, some essential practices can be integrated into construction project management, such as:

1. Design to reduce energy use: Enhancing a building's energy efficiency can be accomplished by incorporating energy-efficient design elements like effective HVAC systems, adequate insulation, and natural light utilisation.
Utilise eco-friendly materials: Select sustainable materials with low carbon footprints, like those that are locally or recycled. One sustainable substitute for conventional wood is bamboo.

2. Use waste management techniques: Construction waste can be reduced by following good waste management procedures like composting and recycling. Furthermore, the need for new resources can be decreased by saving and repurposing materials from renovation or demolition projects.

3. Optimise water efficiency: To cut down on water usage, install rainwater harvesting systems and water-efficient fixtures. Optimising water usage in landscaping projects can also be ensured by utilising intelligent irrigation systems.

4. Make use of renewable energy sources: Power construction sites and buildings with the integration of renewable energy systems, such as solar panels and wind turbines. This could lead to a greener energy mix and less reliance on fossil fuels. The Function of Technology in Project management for sustainable construction technological developments are essential to enhancing sustainability initiatives in construction project management, the study maintains.

2.6. Sustainability challenges facing the construction industry

A good strategy should always account for potential difficulties and roadblocks that can inhibit success (Ries, Gokhan, Nuri, and Kim 2006). Organizations should identify the

greatest threats to their sustainability plan and then specify the specifics of how these threats should be handled. For instance, a major barrier for a firm may be gaining employee support and involvement for sustainability projects (Sharma 2002).

Ayarkwa (2022) found that one of the issues the construction industry faces is inadequate education and training. Every practice that is implemented in the built environment depends on how much access the responsible parties have in education and training. Since sustainability is a relatively new phenomenon, the majority of practitioners lack the necessary training and knowledge to be adequately prepared to implement it. This means that these professionals need to be educated about sustainable building practices. This is only possible if the experts follow the advice given by Chan et al. (2018) about the necessity of creating an extensive national sustainability database that provides experts with precise and current information about sustainable building procedures.

According to Robichaud et al. (2011), construction professionals' level of education and training determines how well they are able to implement sustainable building practices. Project management teams may find it easier to choose appropriate designs and building materials that guarantee sustainability and circularity of materials at end-of-life if the necessary training and education are put into place (Sauvé et al., 2016). Samari et al. (2013) added that one of the main obstacles to the adoption of sustainable building practices in developing nations is a lack of professional knowledge and training. According to Silvius et al. (2012), project management teams in the majority of developing nations don't seem to know much about sustainable building practices.

Zhang et al. (2011) were of the opinion that a project management team must work in accordance with the client's or project owner's requirements. However, performance outcomes may suffer when project management teams lack familiarity with the technologies required to achieve green building certification. Project management teams must stay up to date with the latest developments in the complex modern technologies utilised to achieve sustainability in order to guarantee their implementation (Wu et al., 2019). Project management teams may find it more difficult to achieve sustainable building performance if they are unable to comprehend how new tools and technologies like virtual reality, artificial intelligence, internet of things, and building information modelling work (Silvius et al., 2012). Enhancing project management teams' preparedness for sustainable building processes

requires addressing a significant challenge such as: the lack of knowledge regarding the operation of the necessary tools and technologies to ensure sustainable building (Darko et al., 2018).

According to Shi et al. (2013), industry associations could encourage their members to adopt these practices by disseminating pertinent information about sustainable projects and their advantages. To fully understand the cost-benefits of sustainability, one must take a long-term perspective that takes into account both the project's initial and ongoing costs. The cost benefits of sustainable construction can be realised over time, but regardless of the significant building processes used, there is a significant upfront capital outlay when building a sustainable structure (Wu et al., 2019). There is a lag in the project management teams' application of sustainable practices to improve the sustainable performance of buildings, according to Dwaikat and Ali (2016) and Dobson et al. (2013). This delay was ascribed to the opinions of stakeholders and clients regarding the upfront costs of green building.

The majority of stakeholders do not understand why it is necessary to invest significant financial resources in sustainable building practices when more affordable traditional construction methods are available (Hwang and Tan, 2012). Therefore, persuading clients and stakeholders of the benefits of adopting sustainable building processes becomes a challenge for the project management team. According to Zhang et al. (2011a, 2011b), one of the main obstacles to adopting sustainable building processes is the higher initial cost of green construction practices. This also presents a challenge to project management teams, affecting their willingness to participate in sustainable building processes in the first place. This is consistent with a study by Chan et al. (2017) that found that the cost of green construction is one of the main obstacles to the adoption of sustainable building practices in developing nations.

According to Harby (2021), it will never be simple to persuade people to alter the way they always do things. There's so much more to building sustainably than just pointing to the cost, even though calls for it may be met with derision and mockery. Although there are many obstacles in the way of sustainable construction, it is possible to overcome them with the correct knowledge. Unquestionably, people are hardwired to be resistant to change. Even if it's not impossible, there are always challenges to overcome and barriers to overcome; trying to do things differently in the interest of a more sustainable future is no different. It's crucial

to keep in mind that sustainable building doesn't end when the contractors leave the site; it starts much earlier. It involves making sustainable, "best practice" decisions at every stage of the process. All phases of the building process, including design, construction, and ongoing maintenance, are taken into consideration in sustainable construction. Although they may not be the best friends of all architects, builders, and designers, policies, standards, and regulations exist for a purpose. Sadly, natural materials expert indicated that "building regulations are nowhere near good enough" when it comes to sustainable construction. The absence of regulations is impeding the shift towards using natural materials, which poses difficulties for sustainable building practices. There are some beneficial regulations in place, and efforts are being made to encourage a change in the architecture sector. The study added that "RIBA (Royal Institute of British Architects) is setting standards for architects to bring more sustainable options to the table," and uses those on energy conservation as an example. It all comes down to having the knowledge and awareness of what to aim for and when these regulations fall short in the interim. To achieve "zero carbon" status for the nation by 2050 (or better yet, sooner), it is vital to go well beyond present norms. It appears that rules and regulations are a problem everywhere in the world, not just in the more developed regions. India is a shining example of a place where insufficient laws, regulations, and practices prohibit the widespread use of green buildings. In addition to the lack of policies that promote sustainable building practices, developers and builders frequently have to invest more time, money, and energy because sustainable buildings need even more permissions and clearances.

Governments, organisations, and governing bodies clearly need to take a strong stand when it comes to developing, enforcing, and then keeping an eye on the rules, laws, and legislation surrounding sustainable construction in order to improve the situation, according to Harby (2021). Naturally, the first step in many of these situations must be to examine the current regulations to determine what is effective and what needs to be improved. It should come as no surprise that the massive fossil fuel, plastic, and concrete industries have such influence over the building sector, posing serious obstacles to sustainable building practices. People gravitate towards these products automatically because of their power and the "knowledge, ease, and convenience of what's readily available," according to Janna. They also cost less. According to Janna, "we often choose the less expensive option without really considering all the benefits that would come from a slightly higher quality option." In addition to supply and availability issues, "builders often get scared

off by natural materials and they increase the price unnecessarily" contributes to the higher cost of natural materials. Natural resources that could be utilised for construction are typically easily accessible and therefore reasonably priced in developing nations. High expenses, however, may be incurred because some products and equipment are less well-known and more expensive than conventional options.

Clearly, one of the obstacles to sustainable construction is knowledge according to Tafazzoli (2017). However, there is also a lack of knowledge regarding the functionality and dependability of innovative technologies, as well as how well-performing green buildings work. Furthermore, disagreements over the following issues cause misunderstanding and discourage people from building sustainably: a standard definition of sustainable building practices: what the building's minimal performance standard ought to be. Which building methods, approaches, and activities are more acceptable and which have the least negative effects on the environment. It is imperative that this matter be addressed in order to promote sustainable building practices in both developed and developing nations. People become discouraged and misconceptions about green buildings result from a lack of knowledge and awareness about them.

The challenges of innovation in construction management, as stated in Aydın-Oğuz et al. (2024); Tann (2021) research include: **Resistance to Change:** Because of ingrained procedures and apprehension about upsetting established workflows, the construction sector has historically been resistant to change. It will take strong leadership and persuasive communication to overcome this resistance and convey the advantages and opportunities that come with innovation. **Fragmented Processes:** Architects, engineers, contractors, suppliers, and other stakeholders are all involved in construction projects. Inefficiencies and delays are frequently caused by these parties' lack of cooperation and communication. Project management can be streamlined and this challenge can be addressed by implementing digital platforms and tools for collaboration. **Limited Technology Adaptation:** A lot of construction companies continue to use antiquated technology and labor-intensive manual procedures, which reduces their efficiency and productivity. Planning, designing, and executing projects can be greatly enhanced by utilising digital tools like artificial intelligence (AI), drone technology, and building information modelling (BIM). **Cost Restrictions:** Financial constraints frequently deter investment in cutting-edge technologies and novel approaches. On the other hand, if these innovations are not adopted, there may be missed

opportunities and inefficiencies that eventually result in increased costs. To overcome this obstacle, innovative technologies must be shown to have the ability to save costs. **Lack of Skilled Workers:** The construction sector is facing two challenges: an ageing labour force and a lack of skilled workers. Using cutting-edge technologies can help address this issue by bringing in tech-savvy workers, automating tedious jobs, and decreasing the need for manual labour.

Leeds (2017) discovered that aligning operational and sustainability goals and transversally coordinating them across multiple business units are currently one of the largest challenges facing sustainability managers. Furthermore, it is imperative that the different departments exhibit transparency and initiative in implementing sustainability policies, including the Sustainable Development Goals (SDGs). Fewer people will be able to work in the field if the knowledge is not widely disseminated. In addition to subject matter experts, skilled labourers acquainted with the materials, procedures, and methods are needed for sustainable construction. The designer must specify sustainable building techniques in order for them to be adopted. The report maintained that the designers must understand and be proficient in sustainable construction concepts and methods since they are involved from the outset. Currently, design professionals lack the necessary knowledge to create specifications. One problem they encounter is the absence of well-defined standards that enable them to make direct comparisons between sustainable materials, technologies, and procedures. As such, they take a long time evaluating these components. As labour-saving techniques become more prevalent, issues with the number of workers may arise in later stages. These don't always work well with environmentally friendly building practices. Relevant knowledge is needed not only for installation but also for building maintenance and system upkeep after the building is operational. This is a never-ending cycle until there is adequate and widespread knowledge, the study says.

Lewis (2023) revealed that naturally, it will take time for the infrastructure necessary for sustainable construction to be completely reliable and open to all. However, there is still no necessary frameworks to make it simple to construct sustainable buildings, not even in the most developed countries. Currently, selecting the sustainable option—a clear winner or the list of obstacles to sustainable construction—requires more work, money, time, and effort. This infrastructure must emerge quickly in order to become the standard. For instance, there is currently a lack of established infrastructure for the handling, recycling, and reuse of

materials from deconstruction. The procedure becomes more costly as a result. Even though deconstruction takes more time and labor than demolition, people are discouraged from doing it

Baloi (2003) indicates that although clients, legislators, and other practitioners may occasionally make the assumption that sustainable construction is a hippy, new age, and different style of building, these misconceptions can still be dispelled. It is convinced that rather than just seeing the material alone, people would connect with it more if they understood how all the systems function together—that is, how discussing building entails discussing land, food, and nature as well as taking into account both rural and urban settings. It's all part of one really complex ecosystem. Perhaps by bringing this to people's attention, some people can be persuaded. Chiranjit and Antonio (2023) believe that marketing the concept, layout, and advantages in a way that appeals to the greatest number of people is another component. Naturally, this will change based on the audience, but if appeal is made to the appropriate senses, a hit might be encountered. For example, the general public is likely to be captivated by the health benefits because it directly affects them. Public perception of what "sustainability" really means is one of the obstacles to sustainable construction and what keeps it from becoming more widespread and effective. Developers and investors mistakenly believe that using sustainable building techniques will result in higher capital costs, the report reveals.

As noted by Feraday (2022), traditionally, the goal of the construction industry and all parties involved has been to complete a project as quickly as possible, at the lowest possible cost, and to the highest possible standard. The building's environmental impact during construction and its post-occupancy effects on people, the environment, and the climate are frequently disregarded and viewed as secondary to the financial benefits. There is an unavoidable correlation between the dissemination of information and people's level of knowledge when it comes to changing their minds. Educating professionals and those in related fields first is one strategy to counter this. Encouraging them to modify or adapt their practices and educating them about the potential of sustainable construction will have a greater effect on the sector as a whole. As a result, their attitudes should increase the demand for sustainable projects and solutions by bringing clients' awareness to the forefront.

Trying to strike a balance between the economic, social, and environmental dimensions of the sustainability triangle is the primary cause of most of the obstacles that prevent sustainable construction from becoming a reality**,** Mazur (2023) indicates. Ensure that everything is thought of during the planning phase. Those in charge can also classify the possible challenges you may encounter, resulting in four groups. Obstacles to overcome may come from the following sources: experts, clients, the building sector, and the government. Since every issue raised is related to the others, addressing them all at once is the only practical solution. Examine each challenge separately and collectively, connect the dots, and determine whether your answers adequately address every facet. A project's decision-making process should be comprehensive and well-coordinated. This entails utilizing information from all fields at all times to guarantee that the best tactics are implemented. The study added that the primary shift in mindset that must take place throughout the construction sector is the transition from linear to cyclical construction processes. Urban mining is one approach to achieving this.

For a variety of reasons, according to Mazur (2023), the nations in the Global South are less wealthy than those in the Global North. Less money is available for more ecologically friendly materials and passive systems that would lower the building projects or even the land's operating carbon emissions, which has an impact on sustainable construction. However, the study has noticed that individuals are building their own shacks out of lightweight materials, indicating that sustainable materials are becoming more popular. It has been noted that it can be challenging to persuade people to select the more environmentally friendly option in locations where non-sustainable building materials, such as timber that has been illegally harvested, are less expensive or more accessible than sustainable materials. But programs like the Climate Bonds Initiative (CBIs) and Environmental Product Declarations (EPDs) offer a way to address this. Documents known as Environmental Product Declarations (EPDs) are produced using data from Life Cycle Assessments (LCAs) and serve as a manufacturer's certification of their dedication to lowering the environmental effect of their goods and services. Developers and investors are searching for products with this marker more and more. CBIs provide funding for environmentally friendly projects. The study reported that it is clear that this effort is promoting and bolstering the green economy throughout Latin America. Even though the expense of doing so might need to be covered by

a charity or non-governmental organization, wherever feasible, offices and homes in the Global South should be equipped with construction features that can lower the operational carbon emissions. Because the residents' heating bills were reduced, Cape Town city authorities retrofitted 2,300 homes with solar water heating and roof insulation, lowering their level of poverty. Furthermore, the insulation improved their respiratory health, and the provision of on-the-job training to local residents boosted the local economy (Blackwell **(**2017).

The Global South's sustainable construction solutions are frequently shared with their neighbors because they share similar issues and could use similar approaches to address them. Ibargüengoitia pointed out that Brazil and Colombia, two nations in the region with social housing initiatives incorporating green building principles, have exchanged some of the green technology innovations created in Colombia. He has observed similar trends among Asian and African countries, but regrettably he has also noted a dearth of cross-continental cooperation among the Global South's nations. It should be mentioned, though, that India is very willing to share its innovations in construction. Globalization has also accelerated the flow of ideas from the North to the South. This leads to creative copying of technological solutions using available local resources or inventive invention. The study maintained that more funding must be allocated to the Global South's education and up-skilling programs in order to increase project workers' awareness of the need for and strategies for implementing sustainable construction. All parties involved in a construction project, including project managers, engineers, architects, demolition and construction workers, and subcontractors, should be conversant with the concepts of environmental sustainability and green building, according to the Cape Town Smart Building Handbook. The Global South has far fewer architects and construction engineers than the Global North, despite the two regions having different levels of technical education. Organizations such as the Sustainable Architecture Training Centre in Argentina are addressing this. This Center serves as a venue for the conceptual and practical dissemination of sustainable design techniques. It was constructed with wood and earth, combining modern technology with age-old wisdom and passive design principles. The concept of sustainable construction is not new in the Global South; in 1998, Kuala Lumpur completed the construction of its energy-efficient skyscraper, the TM Tower. However, the expansion of sustainable building in the Global South is being hampered in some ways by a lack of funding and restrictive planning regulations. Nonetheless, there is an

even greater need and a strong desire to expand green concepts and the projects that follow in this industry and in these areas, (Blackwell **(**2017).

According to Mazur (2023), the extraction of raw materials poses the first sustainable design challenge to the detrimental effects of technology on the environment. The minerals and precious metals required to make the electronics we use on a daily basis contribute significantly to greenhouse gas emissions, deforestation, landscape degradation, water, soil, and air pollution, labor violations, and human rights abuses. The private sector and individual businesses must contribute to the efforts of international organizations like the United Nations and World Bank to force governments and industry bodies to implement enforceable standards (e.g., Working Group on Transforming the Extractive Industries for Sustainable Development) such as sustainable water and land use, waste disposal, and social acceptance. This involves avoiding the use of mixed materials and using low-impact, low-polluting materials instead. If a combination of materials is required, make sure the pieces are simple to disassemble so that the various components—such as copper, steel, and plastic—can be recycled independently. It is necessary to use the local durable materials where applicable. Due to the disparity between the amount of electronic waste produced and that which is recycled, all companies in the technology sector must implement sustainable design management practices. This involves providing clients and end users with end-of-life product solutions. This could refer to programs for refurbishment, recycling, or take-back. • Educating consumers and users on proper device disposal techniques and streamlining the procedure as much as possible. Giving outdated computers or printers to nearby organizations that are willing to give them a second chance at life (Mazur, 2023) advises.

Ataul (2019) claimed that unsustainable construction is a large, complex, and fragmented industry that frequently faces issues with over scheduling, cost overruns, and negative effects on the economy, society, and environment. A successful and sustainable project must be finished on schedule, within budget, and without endangering the economy, society, or the environment. When the construction industry faces these issues, it can no longer be sustained. Time overrun: A construction project cannot succeed unless it is completed within the allotted time. But this kind of success is not always attained. It is regrettable that a significant percentage of construction projects fail to be completed within budget, particularly in developing nations. In the construction industry, cost overruns are a very prevalent and undesirable issue.

According to Azhar et al. (2008), there is even a 100% prediction of cost overruns in developing nations. According to various studies, 33% of projects in the UK's construction industry resulted in cost overruns; however, this percentage was significantly higher in developing nations, with the UK accounting for 51% of such cases in Uganda, 81% in Croatia, 58% in Malaysia, and 58.67% in Bosnia and Herzegovina (Jamilus et al 2013). According to Flyvbjerg's research, 90 percent of construction projects worldwide experience a 50–100% cost overrun (Flyvbjerg et al, 2003). The primary causes of cost overruns have been determined to be a lack of implementers' experience, inadequate management and supervision on the job site, inaccurate time and cost estimates, poor scheduling, frequent design modifications or changes, fluctuating material prices, etc. A sustainable society must guarantee that everyone has access to affordable housing and a good standard of living. The chronic lack of housing in many Nordic cities today threatens to significantly increase inequality and impede economic growth. Reducing the time from construction concept to completed plan, construction start, and occupancy is necessary to address this housing shortage. Accelerating the construction process requires an effective planning and construction process. One way to make the zoning process more efficient is to give construction industry operators more authority and manage it closely with municipalities. However, digitalized information management by itself can also increase resource efficiency. Planning and information sharing during the construction process are made easier by the efficient information dissemination made possible by digital document management systems (Jamilus et al., 2013).

Jamilus et al., (2013) believed that the Nordic nations are making great efforts to lessen the impact of the building and real estate industries on the climate. For instance, in Sweden, the building and real estate industries are responsible for roughly 20% of the nation's greenhouse gas emissions, of which a fifth primarily comes from the production of goods and materials used in the upkeep and operation of buildings. By electrifying and improving production and transportation procedures, using more renewable fuels in both production and transportation and making plans for circular flows and resource efficiency, the industry hopes to reduce its greenhouse gas emissions by 50% by 2030. The target is to achieve zero emissions of greenhouse gases by 2045. The use of materials accounts for nearly half of the greenhouse gas emissions from the building and real estate industries. Our current relationship with the selection and use of materials in society is unsustainable, necessitating increased social responsibility in our supply chains. Collectively, we must reorganize and improve our ability

to produce reusable, non-toxic material flows that are more effective in both design and use, according to Ayarkwa et al., (2022).

According to Construction Blueprint 2020, women make up only 8.2% of all EU workers in the construction and real estate industries. For the construction industry to become more gender-equal, modifications must be made to the physical, psychosocial, and organizational working environments. In the construction industry, everyone ought to be made to feel at home. Increasing diversity fosters innovation and growth in the construction sector, which advances safer and more effective working methods. Although the construction industry has been slow to adapt to corporate responsibility, growing regulations in areas like waste management and carbon emissions are pushing businesses to streamline their operations, and a growing number of clients are starting to request responsible design and construction methods.

The goal of corporate responsibility (CR) is to help companies become more adept at meeting stakeholder needs and making sure their operations are sustainable. This implies that it applies to businesses of all sizes that are involved in the industry supply chain, such as customers, designers, contractors, and material suppliers. Following in the footsteps of Business in the Community (BITC), constructing excellence views Corporate Responsibility as consisting of four components: • Marketplace, Community, Workplace, and Environment. Climate change mitigation in new construction and business operations, as well as preparing for future climate change conditions, are factors to take into account when developing a construction company's strategy. Biodiversity and waste reduction (both on-site and in the office) are important aspects of environmental CR, as is water management, including drainage and water conservation. Incorporating workplace accessibility, preventing discrimination, and treating employees fairly are crucial components of any Corporate Responsibility plan. The Investors in People Standard provides a framework for formulating plans of action, assessing performance, and determining outcomes. Any corporate responsibility strategy must take into account factors like time management, the workplace environment, health and safety, diversity and recruitment, and skill development. An effective community relations (CR) plan will aim to interact with the community locally and occasionally worldwide. Businesses can positively impact the communities in which they operate by generating employment, offering apprenticeships and training programs, encouraging employee volunteerism, and collaborating with local, national, and international

non-profit organizations. It is crucial to take into account concerns about volunteerism, sustainable communities, and the effects of construction on local populations (Sharma, 2002). Profitability depends on corporate responsibility. As a result, a business can increase its financial performance by conducting its operations ethically and taking social and environmental factors into account. It is crucial to take into account when purchasing building supplies and office equipment, as well as to collaborate with the supply chain to harmonize CR policies and values, the report indicates.

The building and construction sector is accountable for the high energy consumption during the construction and operation phases, as well as the emission of pollutants such as carbon dioxide. The building and construction sector bears direct and indirect responsibility for the high energy consumption during the construction and operation phases. In addition to the carbon dioxide generated, construction activities and occupied buildings also generate a host of other pollutants. Throughout a building's lifetime, careful planning and design can significantly reduce pollution and energy use. More environmentally friendly options are becoming more and more common, and many of them can save a significant amount of money in addition to having positive effects on the environment. This is especially true when long-term benefits are fully taken into account and when they are taken into account as early in the project as feasible (Chiranjit and Antonio, 2023)

According to Blackwell (2017), one of the most significant developments in construction at the beginning of the twenty-first century was sustainability. Leaders in the construction sector are under intense pressure to make a commitment to delivering a sustainable built environment. Even so, leaders still have a lot on their plate in 2017. For example, how is the current political and economic climate affecting the transition to sustainable construction? The UK government's plans to target zero carbon construction for new non-domestic buildings by 2019 were discussed in 2014. Nevertheless, these plans were abandoned in 2015 when the government declared that it "will keep energy efficiency standards under review, recognising that existing measures to increase energy efficiency of new buildings should be allowed time to become established" and that it "does not intend to proceed with the zero carbon Allowable Solutions carbon offsetting scheme." In the absence of government pressure or enhanced support, companies are obligated to take the initiative to transform into sustainable developers. It was seen in 2014 that the industry was taking a while to react to these government regulations, but how does that relate to the development of sustainable

building in 2017? If there are no political pressures, will developers choose a sustainable path? In 2014, there was discussion about how businesses were under pressure to follow sustainable practices and meet deadlines. Since developers are no longer subject to time constraints from the government, will using green materials be seen as more viable? Although many believe that sustainable building is costly, this is less of an acceptable justification as consumer demand for sustainability rises. High-performance buildings can command a higher price, according to the World Green Building Trends 2016 Smart Market Report. The typical green building is valued 7% higher than a conventional one. Green buildings are more appealing to customers because they are less expensive to operate. The market for green buildings is growing every three years, according to the report. Although building green can seem costly at first, there are many benefits in the long run. The primary obstacle facing the industry is attaining sustainability, let alone covering the associated costs. In addition to being the largest user of raw materials, the construction industry is responsible for 25–40% of global carbon emissions. Water management and climate change are two of the industry's biggest problems. To truly understand sustainable construction, the industry needs to adopt a new project management methodology, the study maintains.

The construction industry faces several major sustainability challenges, primarily related to the amount of waste produced during production processes, the need to meet the growing demand for sustainable building materials. Reducing negative externalities, streamlining procedures, and guaranteeing safe work practices are additional difficulties. The construction sector also has to deal with issues with contract management, information and communication management, and project delays. The implementation of sustainable construction practices is also impacted by financial difficulties, such as false beliefs about the value of land, an absence of affordable consulting fees, and the expense of disposing of waste. These difficulties show that the construction sector needs to look for different approaches to improving its sustainability, like implementing industry technologies and switching to circular economy principles (Prof. Dr. Cramer, 2023)

Whatever obstructs one's path is considered an obstacle, according to Ogunmakinde, Sher, and Maund (2016). It hinders transitioning between stages. Development is accompanied by challenges, which can prevent projects from succeeding. The following factors can prevent a project in the construction industry from being completed successfully: a small budget, bad

weather, obtaining permissions or approvals, labor, and unforeseen circumstances. Completion delays, higher building costs, and sustainability concerns are a few outcomes of these challenges. In many areas of life, sustainable development (SD) has received a lot of attention and adoption. In order to accomplish what is ecologically feasible, it aims to integrate environmental, social, and economic factors (Emmanuel, Ibrahim & Adogbo, 2014). In a number of fields, including the built environment, agriculture, production, and health practices, the phrase is now widely recognized and in use. Different strategies have been put forth by these sectors to attain SD. An approach that takes into account the demands of the construction industry is called sustainable construction, or SC. Achieving sustainable development is its goal (Abidin, 2010). The sector has come under fire for its role in environmental deterioration, which runs counter to the ideas of sustainable development (Pearce, 2005).

A survey of the literature by (Dania et al., 2007; Oko & Emmanuel, 2013; Pearce, 2005) revealed the significant environmental effects that construction projects impose. These emphasize how important it is to build sustainably. Building industries in both developed and developing nations are becoming increasingly concerned with the creation of a more sustainable built environment. Developed nations have made, and continue to make, concentrated efforts to attain it. A number of sustainable buildings as well as laws and policies have been produced as a result of these efforts. While some developed countries have seen success with SC, developing countries now face the challenge of following suit. SC is comprehensive and could present issues (Leiserowitz, Kates, & Parris, 2006). All parties involved must put forth enormous effort, but they must overcome internal and external barriers. External factors like bad weather are examples of extrinsic obstacles, whereas internal factors like a tight budget are examples of intrinsic obstacles. A seamless transition to SC practices is impeded by these factors. Moreover, in order to attain SC, construction professionals must make sure that they incorporate sustainable development strategies into their operations (Cotgrave & Riley, 2012; Mostafavi & Doherty, 2010; Newman, Beatley, & Boyer, 2009; Newton, 2012).

Nwokoro and Onukwube (2015) listed the following as the difficulties in constructing sustainably: opposition to change monetary rewards, the industry's culture, Insufficient instruction and training Insufficient ability of the sector, uncertain state of the economy, Low urban investment and poverty Insufficiently precise data Disinterest in the problems facing

SC Absence of reliable substitute technology, Absence of comprehensive research, Lack of comprehension, awareness, and knowledge about SC, increased SC costs, procurement-related concerns, erecting obstacles to regulations, restricted exposure to experts, Absence of domestic material production, Absence of examples for demonstration, Absence of a planning policy, unclear SC definition, unclear business case, lack of client demand, and lack of measurement standards requirements of clients, Absence of oversight and enforcement of the law, Unsuitable priority, unfavorable public perception, lack of a shared information foundation, Significant political instability and a lack of coordination.

The process of rising global temperatures brought on by an increase in greenhouse gas concentrations, such as carbon dioxide, is known as global warming. Carbon dioxide emissions from the burning of fossil fuels for energy production are significant. At various stages of the construction life cycle, this energy is used. An additional significant factor in global warming is the greenhouse gases (GHGs) released during the extraction, manufacturing, transportation, installation, use, upkeep, and disposal of building materials. Natural disasters and extreme weather are caused by global warming (Cotgrave & Riley, 2012).

Biodiversity and habitats are lost as a result of the amount of land required for building projects or resource extraction. As a result, it causes species to become extinct. Natural habitats and biodiversity are crucial components that keep the ecosystem in balance. Large amounts of sulphur and nitrogen compounds are released during the burning of fossil fuels used in the production and delivery of building supplies. These substances have the potential to dissolve in water bodies if improperly disposed of. Their solid forms may also persist in soils or surface waters. The main factor causing acid rain in the environment is this acidification (Newton, 2012).

Particles in the air with diameters less than 10 micrometers are produced by the construction industry. As a result, these particles are invisible. Both liquid and solid airborne particles are harmful to the environment and people. The majority of airborne particles are released into the atmosphere as a result of construction and extraction operations, including aggregate mining, equipment operation, electricity generation, manufacturing, and material transportation. When heavy metals are present in the atmosphere, toxicity rises. When levels of heavy metals in the water surpass acceptable thresholds, people begin to experience health

problems. The main sources of hazardous metals are the production and delivery of building supplies (Adeniyi, 2020).

The capacity to perform groundwater recharge is diminished when impermeable and non-biodegradable building materials contaminate water resources. The hydrological cycle is drastically altered by the depletion and pollution of water resources. Large-scale water consumption for extraction and construction projects depletes the resource. Following construction, the pollutants and byproducts are disposed of by returning them to water bodies. As a result, it contaminates waterways. Building requires a lot of land. As a result, forest resources must be occupied by humans. This demand continues to rise as urbanization increases. The loss of trees and forest land due to construction is still a growing trend. It is crucial to preserve these forests because they have the capacity to contain more than half of the world's biodiversity. The first step in solving this problem is realizing the environmental risks that construction poses. Every year, new techniques for building sustainably emerge to address this issue (Abdulrahman et al. 2020).

Many businesses need to crawl before they can walk when it comes to sustainability issues. Put differently, sustainability will be an ongoing process involving numerous variables. There is the actual implementation. Manufacturers need to have a firm understanding of the factors that are changing in terms of regulations. In order to meet the sustainability credential, you also need to make sure that your product lifecycle—from design to suppliers and production—is green. Lastly, price has always been and will continue to be a key factor. Therefore, it is not unexpected that manufacturers deal with a variety of sustainability-related issues (Ametepey and Ansah, 2014).

The process of rising global temperatures brought on by an increase in greenhouse gas concentrations, such as carbon dioxide, is known as global warming. Carbon dioxide emissions from the burning of fossil fuels for energy production are significant. At various stages of the construction life cycle, this energy is used. Additionally, the production of concrete has produced about 2.8 billion tonnes of CO2, a number that is anticipated to increase in the years to come. An additional significant factor in global warming is the greenhouse gases (GHGs) released during the extraction, manufacturing, transportation, installation, use, upkeep, and disposal of building materials. Natural disasters and extreme weather are caused by global warming. Biodiversity and habitats are lost as a result of the

amount of land required for building projects or resource extraction. As a result, it causes species to become extinct. Natural habitats and biodiversity are crucial components that keep the ecosystem in balance (Yurdakul & Kazan, 2020).

Large amounts of sulphur and nitrogen compounds are released during the burning of fossil fuels used in the production and delivery of building supplies. These substances have the potential to dissolve in water bodies if improperly disposed of. Their solid forms may also persist in soils or surface waters. The main factor causing acid rain in the environment is this acidification. The construction sector produces airborne particles with diameters ranging less than 10 micrometers. Consequently, these particles are invisible. Humans and the environment are harmed by airborne particles, whether they are liquid or solid. The majority of particulates that are in the air are released by processes related to building and extraction, including aggregate mining, using construction equipment, generating electricity, manufacturing, and material transportation. When heavy metals are present in the atmosphere, toxicity rises. When levels of heavy metals in the water surpass acceptable thresholds, people begin to experience health problems. The main sources of hazardous metals are the production and delivery of building supplies (Shahzad et al., 2022).

The capacity to perform groundwater recharge is diminished when impermeable and non-biodegradable building materials contaminate water resources. The hydrological cycle is drastically altered by the depletion and pollution of water resources. Large-scale water consumption for extraction and construction projects depletes the resource. Following construction, the pollutants and waste products are dumped back into water bodies. As a result, it contaminates waterways. Building requires a lot of land. As a result, forest resources must be occupied by humans. This demand continues to rise as urbanization increases. The loss of trees and forest land due to construction is still a growing trend. It is crucial to preserve these forests because they have the capacity to contain more than half of the world's biodiversity. The first step in solving this problem is realizing the environmental risks that construction poses. Every year, new techniques for building sustainably emerge to address this issue (Aydın Oğuz et al., 2024)

According to Baloi (2003), sustainable construction is essentially sustainable development with an emphasis on the building sector. Its definition is "the development and responsible management of a healthy built environment grounded in ecological and resource-efficient principles" (Kibert, 1994). Although there have always been worries about the state of the environment, it is only recently that practical and effective solutions have become the focus. In Rio de Janeiro, Brazil, Agenda 21 was created in 1992 as a global framework for sustainable development, which encompasses both environmental and development aspects. The Agenda is a comprehensive plan of action that the UN System, governments, businesses, interest groups, and society at large are to implement on a global, national, regional, and local level. Alternatives are provided by Agenda 21 to stop the deterioration of the land, water, and air as well as to protect the variety of plants and animals. Since then, efforts have been made by all sectors of the economy and society, including the industries, to translate and pursue sustainability within their unique contexts. The Habitat Agenda and CIB A21 have been established to set a specific sustainability agenda for the construction industry. The International Council for Research and Innovation in Building and Construction (CIB) released Agenda 21 for sustainable construction in 1999. The following are the fundamental ideas of sustainable construction: The objectives are to maximize the reuse of resources, minimize their consumption, employ recyclable and renewable resources, protect the environment, create a safe and healthy environment, and create high-quality built environments. Unlike the traditional perspective, which prioritized economy, utility, and durability, sustainable construction takes into account three main dimensions: social, economic, and environmental. The social dimension pertains to matters concerning the improvement of individuals' standard of living. The economic dimension deals with matters of economics, including the creation of jobs, the improvement of competitiveness, the reduction of operating and maintenance costs, the creation of jobs, the creation of high-quality working environments that increase productivity, and many other things. The environmental dimension is concerned with methods of design, construction, operation/maintenance, and deconstruction that reduce harmful effects on the environment, including waste discharges, air emissions, water resource use, and land use (Baloi, 2003)

The global concern is the construction industry's contribution to sustainability. Nonetheless, compared to the developed world, developing nations face far larger and more complicated problems. Low income, inadequate health and education systems, inadequate sanitation and

water supply systems, a lack of skilled labor, inadequate funding, and many other issues are typical of developing nations. In contrast to the developed world, where these needs are frequently met or even exceeded, the majority of the time the most basic human needs are not met (Loh, 2000). Therefore, it is not unexpected that the majority of resources available are focused on finding solutions to the most fundamental issues. There are major disparities between the two worlds in terms of institutional capacity, construction industry capacity, priorities, and skill levels. Developed nations typically approach sustainable construction issues from a technological perspective, owing to their significant technological advancements. This is the rationale behind the significant technological component of the research and development agenda for sustainable construction. Economic success is more heavily influenced by innovation and technology development capacity than by more conventional measures of comparative advantage. However, Welford (1996) emphasized that scientific and technological advancements by themselves are insufficient, and it is unrealistic to expect them to solve every mistake made in the past and open up new avenues for the future.

Developing nations must focus on people's choices and behaviors in addition to technology since these factors are the primary drivers of sustainable construction and stem from a people-centered perspective of development (www.csir.co.za/akani). This indicates that there is a pressing need for people's attitudes toward production to change. Agenda 21 for Sustainable Construction in Developing Countries is necessary because of the unique issues that developing countries face and the limited resources available for sustainability initiatives. The Agenda will assist in developing sustainable practices that are appropriate for these nations. The scope and context of this agenda are different from those of others. UNEP-IETC, CSIR Building and Construction Technology, and the Construction Industry Development Board of South Africa are working together to jointly formulate the agenda, which is still in the process of being completed (Gibberd, 2001). Building companies must come up with suitable solutions to address environmental regulations. These include technological innovation, managerial process improvements, and adherence to regulatory frameworks. Establishing environmental management systems, or EMS, are the standard way that organizations get ready to take on environmental activism. The most suitable kind and size of EMS to be installed depend on the company's size, goals, and operations (Milanese et al., 2022).

An approach to environmental management EMS is the formal framework of an organization that includes the policies, practices, tools, and procedures used to carry out environmental management (Griffith, 1994). It helps businesses to react proactively to environmental issues and legal and regulatory requirements. An environmental management system incorporates the Baloi (2019) consideration of inputs, outputs, and the corresponding impacts, and it focuses on an organization's activities that may have an impact on the environment. Impacts are typically ranked and prioritized based on importance. In an ideal world, all parties involved in the construction industry—clients, suppliers, contractors, consultants, and regulatory agencies in particular—should embrace EMS to acknowledge the environmental effects of construction.

Building sustainably presents a lot of opportunities as well as challenges. The necessity to balance the three primary sustainability dimensions—economic, social, and environmental—is the primary cause of these opportunities and challenges. Miyatake (1996) asserts that all parties involved must recognize that achieving sustainable construction necessitates a shift from linear to cyclical approaches in the processes used to create built environments. That is to say, the building sector needs to alter the way it conducts all construction-related activities, giving special attention to material reuse and recycling as well as lowering the amount of energy and natural resources used. Finding the ideal balance between economic and environmental performance is crucial for the construction sector. For this purpose, a variety of approaches, strategies, and instruments are available, including Life Cycle Costing (LCC) and Life Cycle Assessment (LCA) for buildings. Reaching this equilibrium is not a simple or cost-free process. The advantages and disadvantages of sustainable construction have been hotly contested by scholars and industry experts. It appears that two opposing viewpoints regarding the difficulties and possibilities of sustainability will not be reconciled anytime soon. Some industry participants view sustainability as a burden, while others believe it makes sound business and financial sense.

Porter (1991) argues that there is no real conflict between economic competitiveness and environmental protection. It is the result of a static conception of competition and a limited understanding of the sources of wealth. Regulations and laws pertaining to the environment shouldn't be seen as barriers to competitive advantage. Tight standards, on the other hand,

spur innovation and modernization. Strict regulations have the power to push businesses to innovate and create high-value, less-polluting products. This viewpoint holds that the adoption of sustainable practices is a catalyst for ongoing innovation and new market opportunities rather than an expense. Implementing sustainable practices has advantages for both the process and the final product. Process benefits include reduced energy consumption during production, reduced costs of activities related to discharges, waste handling, and transportation, savings from safer working conditions, and savings on materials due to reuse, recycling, and conversion of waste into valuable forms. Benefits of the product include safer construction methods, reduced life cycle costs, and better construction quality. On the other hand, achieving sustainability faces some significant obstacles. At the macro, meso, and microeconomic levels, sustainable construction faces numerous financial obstacles, according to Bon (www.iris.ba.cnr.it). First, the output of construction has been declining in the developed world; second, while output in developing nations has been steadily increasing, it is important to acknowledge that sustainability is still a far distant goal. Thirdly, the building industry depends on the adoption of sustainability practices from other economic sectors, such as the producers of building materials and components. Sustainable construction is challenging in every nations. Most people would agree that most corporate environmental programs have been driven by fear rather than greed, the report indicates.

Roberts (1997) asserts that even though some businesses have started environmental management initiatives ahead of laws, the primary reason for their actions is the possibility of legal action. In addition to the financial difficulties that arise, construction companies also have to handle other problems that are unique to their projects, like the need to manage the environment in various locations. Stavins (1996:47), however, carried out a statistical analysis from over 100 government and academic studies, which aids in identifying some of the issues. The primary finding was that, in actuality, environmental management implementation presents both opportunities and challenges, lying in the middle of the two extremes. Long-term economic growth and the implementation of environmental management systems are mutually reinforcing, according to Kleiner (1991).

According to Harby (2021), it will never be simple to persuade people to alter the way they always do things. There's so much more to building sustainably than just pointing to the cost,

even though calls for it may be met with derision and mockery. Although there are many obstacles in the way of sustainable construction, it is possible to overcome them with the correct knowledge. Unquestionably, people are hardwired to be resistant to change. Even if it's not impossible, there are always challenges to overcome and barriers to overcome; trying to do things differently in the interest of a more sustainable future is no different. It's crucial to keep in mind that sustainable building doesn't end when the contractors leave the site; it starts much earlier. It involves making sustainable, "best practice" decisions at every stage of the process. All phases of the building process, including design, construction, and ongoing maintenance, are taken into consideration in sustainable construction.

Natural resources that could be utilized for construction are typically easily accessible and therefore reasonably priced in developing nations. High expenses, however, may be incurred because some products and equipment are less well-known and more expensive than conventional options. Although the higher upfront costs may be disconcerting, there may be additional obstacles, such as a dearth of trustworthy cost models that would enable developers, financiers, contractors, building owners, etc. to comprehend the true costs and advantages of sustainable building. Theoretically, as more information and studies are published in the construction sector, this knowledge gap should gradually close. It's critical that we concentrate on the long-term financial gains in order to attract investors, secure funding for your sustainable construction project, and eventually witness the addition of more future-proof structures to our city's skylines (David Hickey and Jason Hickey, 2021).

Determining and comparing the lifecycle costs or embodied energy of materials, building components or the building itself can be extremely challenging for architects and designers. For instance, they might be trying to strike a balance between the material's procurement, manufacturing, transportation, and installation effects on the occupants' health and air quality. Lastly, they might be considering whether the material can be recycled when the building reaches the end of its useful life. However, there's no need to freak out because a number of approaches are already being used more frequently to evaluate these areas as well as the affordability and efficiency of sustainable building. For assessing the long-term advantages, Life Cycle Costing (LCC) is the best method; Life Cycle Assessment (LCA) is an additional choice. These can be used to make sure a structure can strike a balance between its economic

and environmental performance. However, comprehensive life cycle assessments and carbon footprint computations in any format should be promoted (Blackwell**,** 2017).

Clearly, one of the obstacles to sustainable construction is knowledge as stated by Mahamud, (2019). However, there is also a lack of knowledge regarding the functionality and dependability of innovative technologies, as well as how well-performing green buildings work. Furthermore, disagreements over the following issues cause misunderstandings and discourage people from building sustainably:

•A standard definition of sustainable building.

• What the building's minimal performance standard ought to be.

• Which building methods, approaches, and activities are more acceptable and which have the least negative effects on the environment.

How to assess a building's sustainability

It is imperative that this matter be addressed in order to promote sustainable building practices in both developed and developing nations. People become discouraged and misconceptions about green buildings result from a lack of knowledge and awareness about them. There's also misinformation to address. Nonetheless, advancements are continuously being made in this field due to the growing number of specialists. The emphasis is on information exchange and making sure individuals have the abilities and particular knowledge required to participate in the sustainable construction movement, practice sustainable building, and propagates awareness which are more acceptable and which are harmful. There will be fewer persons qualified to work in the field if the knowledge is not widely disseminated. Sustainable construction calls for subject matter experts in addition to skilled laborers who are knowledgeable about the materials, procedures, and techniques. The designers must understand and be proficient in sustainable construction concepts and methods since they are involved from the outset. Currently, design professionals lack the necessary knowledge to create specifications. One problem they encounter is the absence of well-defined standards that enable them to make direct comparisons between sustainable materials, technologies, and procedures. As such, they take a long time evaluating these components (Mahamud, 2019).

As labor-saving techniques become more prevalent, issues with the number of workers may arise in later stages. These don't always work well with environmentally friendly building practices. Relevant knowledge is needed not only for installation but also for building maintenance and system upkeep after the building is operational. This is a never-ending cycle until there is adequate and widespread knowledge: the fewer experts there are the fewer people there are to train the eager to learn. But because of individuals as well as global movements and organizations, there is hope. Naturally, it will take time for the infrastructure necessary for sustainable construction to be completely reliable and open to all. However, you still won't find all the necessary frameworks to make it simple to construct sustainable buildings, not even in the most developed countries. Currently, selecting the sustainable option—a clear winner or the list of obstacles to sustainable construction—requires more work, money, time, and effort. This infrastructure must emerge quickly if needed to become the standard. There is a need to dispel the misconception held by clients, legislators, and other professionals that sustainable construction is a hippy, new age, and entirely different style of building. It is convinced that rather than just seeing the material alone, people would connect with it more if they understood how all the systems function together—that is, how discussing building entails discussing land, food, and nature as well as taking into account both rural and urban settings. Marketing the concept, layout, and advantages in a way that appeals to the greatest number of people is another component. Naturally, this will change based on the audience, but if you appeal to the appropriate senses, you might have a hit. For example, the general public is likely to be captivated by the health benefits because it directly affects them (Blind and Heß, 2023).

According to Alves et al.(2018), public perception of what "sustainability" really means is one of the obstacles to sustainable construction and what keeps it from becoming more widespread and effective. Traditionally, the goal of the construction industry and all parties involved has been to complete a project as quickly as possible, at the lowest possible cost, and to the highest possible standard. The building's environmental impact during construction and its post-occupancy effects on people, the environment, and the climate are frequently disregarded and viewed as secondary to the financial benefits. There is an unavoidable correlation between the dissemination of information and people's level of knowledge when it comes to changing their minds. Educating professionals and those in related fields first is one strategy to counter this. Encouraging them to modify or adapt their practices and educating

them about the potential of sustainable construction will have a greater effect on the sector as a whole. As a result, their attitudes should increase the demand for sustainable projects and solutions by bringing clients' awareness to the forefront.

According to Prof. Dr. Cramer (2023), there are numerous obstacles and complexities in the way of the construction industry's shift towards sustainability. It has long been believed that the construction industry adopts new ideas and advances in technology slowly. This is explained by the conventional character of construction activities as well as the fragmentation of the industrial ecosystem. Many professionals must be involved in the construction process, which results in a complex network of stakeholders. Beyond this, supply chains for construction are frequently complex, requiring inputs and services from a range of sources, including suppliers of energy-intensive building materials like steel, glass, aluminum, and mineral products like cement, concrete, and products made from it; chemical products like paint, varnish, and asphalt; and clay products like bricks and tiles. Trade with third world countries is a common source of these materials. Additionally, the construction sector faces persistent problems like material waste generation, which accounts for roughly 10% of material costs, cost overruns, which average 14% of contract costs, and project delays, which impact 70% of projects. There are several obstacles that stand in the way of the shift to a sustainable construction ecosystem:

• Insufficient standards for secondary materials and disagreements over end-of-waste status • difficulties in comparing construction products based on environmental criteria

• Limited awareness within the construction industry; unfavourable market conditions and a lack of financial incentives hinder economic feasibility.

Commercial, structural, and regulatory obstacles are similar in the steel construction industry. Steel producers are reluctant to invest in green technologies due to the industry's generally narrow profit margins. A further challenge is that individual developers do not regularly factor in emissions from the steel they use. The lack of industry standards, inconsistent regulations, and inadequate instruments for measuring embodied carbon are some of the factors that lead to this predicament. A highly fragmented construction landscape presents the third major obstacle to adoption, which is related to the services provided by the steel

industry. Achieving meaningful change on a large scale becomes extremely difficult in this complex context (Erika et al. 2020).

According to Doug (2023), a significant obstacle confronting the construction sector at the moment is the intricate process of incorporating sustainable elements into conventional building methods. Construction professionals are now required to incorporate energy-efficient systems, recycled materials, and renewable energy sources due to the tightening regulations on sustainable building. A higher level of expertise is required for the successful integration of sustainable features, which means that builders must adjust to new, possibly unfamiliar or less standardized technologies and methodologies. Unfortunately, there is currently a dearth of knowledge in this area, which puts a great deal of risk. Implementation errors could result, jeopardizing the overall efficacy of sustainable features. Even with the long-term benefits like lower energy consumption and operating costs, many developers are often discouraged by the upfront costs associated with sustainable building design. Project budgets may be severely impacted by the initial investment needed, which presents risks that might not be immediately offset by the anticipated savings over the building's lifetime. Financial concerns are further compounded by the possibility of delays or cost overruns during the construction phase. The utilisation of sustainable construction methods and the requirement for specialised materials can result in unforeseen challenges that can impact project timelines and financial viability, the report indicates.

Governments all over the world are enforcing strict environmental standards and building codes to encourage sustainable practices as environmental awareness grows. There may be severe fines and legal repercussions for breaking these rules. The construction industry faces a persistent challenge due to the ever-changing and dynamic nature of regulations. It's a difficult job that calls for continual attention to detail to stay informed about any new developments and make sure that building projects comply with the most recent environmental regulations. In addition to endangering the financial viability of projects, noncompliance with compliance standards damages the reputation of construction companies and may result in lost future business opportunities (Porumboiu, 2021).

Delivering sustainable buildings presents unique challenges for quantity surveyors and main contractors in the construction industry. When it comes to sustainable materials and technologies, which might not have standardized pricing, quantity surveyors face challenges in precisely estimating costs. The role of sustainable technologies is further complicated by the fluctuating cost of materials and their evolving nature. However, primary contractors are also responsible for managing the coordination of different specialty subcontractors and guaranteeing the smooth incorporation of sustainable elements into the project plan as a whole. Project timelines and budgets may be impacted by delays and coordination problems brought on by this increased complexity. There's a real chance that there won't be enough active learning and adaptation to these changes as the construction industry changes to better embrace sustainable practices. This highlights how crucial it is for construction professionals to keep learning and adapting in order to successfully navigate sustainable construction. To ensure precise cost estimates and smooth project execution, quantity surveyors and main contractors should stay current on the most recent advancements in sustainable technologies and materials. It's also critical to promote an innovative and flexible culture in construction companies. Using cutting edge project management tools and emerging technologies like Building Information Modeling (BIM) can improve stakeholder collaboration and expedite procedures. This puts construction companies at the forefront of industry advancements and enhances efficiency. In order for the construction industry to successfully address the issues surrounding sustainable building design, collaboration is essential. To establish a cooperative and encouraging atmosphere, regulators, environmental organizations, builders, developers, and architects must cooperate with one another. In order to hasten the industry's collective learning curve and promote a more seamless transition to sustainable construction practices, this involves exchanging best practices, lessons learned, and success stories (Blind and Heß, 2023).

Sustainable building materials should ideally be locally sourced in order to minimize the amount of air or road miles required to transport them to the construction site, according to Ogunmakinde, Sher, and Maund (2016). According to Bundit Pradabsook, the Commissioner of The Association of Siamese Architects under Royal Patronage, this is the situation in Thailand. According to the report, there are several benefits to using dry wall materials in high-rise buildings. One of the main ones is that the use of gypsum can result in occupants saving up to 27% on their air conditioning bills. Furthermore, the material can be obtained

locally, which minimizes the distance travelled by road to reach the location. When comparing per square meter, dry wall is less expensive to transport because it is six times lighter than precast concrete wall. In the Southern Cone of Latin America, local and traditional building materials are also employed, which modifies the structure and design of the construction project. An effective campaign to encourage the use of adobe or compacted earth has been launched in place of concrete blocks, which are made with a lot of water and have a high carbon footprint, and cement. The drawback of this material is that it needs regular upkeep, which makes it inappropriate for commercial and vertical building projects. Because adobe naturally produces thick walls that are energy-efficient, this material is best suited for single-story buildings, or more specifically, homes and dwellings. For a variety of reasons, the nations in the Global South are less wealthy than those in the Global North. Less money is available for more ecologically friendly materials and passive systems that would lower the building projects or even the land's operating carbon emissions, which has an impact on sustainable construction. Due to the fact that installing or purchasing those solutions can be costly, however, the report has noticed that individuals are still building their own shacks out of lightweight materials, indicating that sustainable materials are becoming more popular.

It has been discovered that persuading people to select the more environmentally friendly option can be challenging in locations where non-sustainable building materials, such as timber that has been illegally harvested, are less expensive or more accessible than sustainable materials. But programs like the Climate Bonds Initiative (CBIs) and Environmental Product Declarations (EPDs) offer a way to address this. Documents called Environmental Product Declarations (EPDs) are created using data from Life Cycle Assessments (LCAs) and serve as a manufacturer's certification of their dedication to lowering the environmental effect of their goods and services. The greater upfront cost of sustainable construction as opposed to conventional techniques is one of the biggest obstacles. Green building materials, energy-efficient systems, and the requirement for professional certifications are the main causes of this. The project's overall cost may go up even though these components help create a more sustainable and eco-friendly building. Nevertheless, it's crucial to remember that over time, energy savings and increased building value can frequently offset these initial expenditures. Incorporating sustainable materials and

energy-efficient systems allows developers to build buildings that are more resilient and economical over time, while also lowering their carbon footprint. Sustainable building is a wise investment because of its long-term advantages and favourable effects on the environment, even though the initial cost may seem high. It is difficult for people used to traditional construction techniques to adopt a sustainable construction mindset because it requires a fundamental change in perspective. It includes adopting a more sustainable mindset in addition to having a thorough awareness of novel materials, state-of-the-art techniques, and building regulations (Wen and Qiang, 2022).

The industry's general lack of expertise and understanding of sustainable practices can make this transition especially difficult. But the conditions for a more ecologically conscious and greener future in the construction industry could be created if these new ideas are adopted and keep improving our knowledge. It is clear that building codes and regulations have not kept up with the rapid advancements in sustainable construction practices, even with some recent progress. The existing codes, which are mostly based on conventional building techniques, can present serious difficulties and needless barriers for green builders who are trying to integrate sustainable solutions. Furthermore, getting approval for creative sustainable designs can often be a lengthy and complex process that involves many parties and factors. The increasing demand for eco-friendly construction has made it imperative for regulatory frameworks to change and adapt in order to facilitate the smooth incorporation of sustainable practices into the built environment. Although consumers are becoming more conscious of the value of sustainability, it is regrettable that there is still little demand for green buildings. People must be made aware of the many advantages of sustainable building for their own health and well-being as well as for the environment (Mashwama et al., 2020).

Green buildings can enhance indoor air quality and drastically lower their carbon footprint by implementing eco-friendly techniques like energy efficiency and the use of renewable materials. Still, developers face an uphill battle in trying to defend the higher upfront costs of green building due to the lack of demand. Continuing to raise awareness and emphasize the long-term benefits of sustainable construction is crucial to creating a stronger market for green buildings. It is quite reasonable to be optimistic about the future of sustainable construction, even in spite of the many obstacles that lie ahead. Environmentally friendly

construction materials and energy-saving technologies are becoming more and more affordable. Additionally, by giving professionals the skills they need to adopt sustainable practices, education and training programs are significantly contributing to closing the knowledge gap within the industry. Furthermore, as a result of policy changes, developers are increasingly adopting sustainable construction practices, opening the door to a more ecologically friendly way of building. There is a rising need for sustainable building solutions as the effects of climate change become more obvious. Consumers with knowledge are actively looking for environmentally friendly options for every part of their lives, including the buildings they live in. Although there are still challenges in the path of sustainable construction, the sector is making great strides in overcoming them. With continued innovation, education, and policy changes, sustainable building looks to have a bright future. It is indisputable that implementing sustainable practices has positive environmental effects for both our planet and the welfare of future generations. As a result, the work put into sustainable building is genuinely valuable and helps ensure a better future (Ewa Zender – Świercz, 2020).

All new construction must adhere to energy performance standards, but even more crucially, we must make sure that the vast majority of the country's existing housing stock is updated and brought into compliance with 21st-century standards. To meet climate change targets, all buildings must operate at net zero in order to be truly environmentally sustainable. For residential buildings, the Total Energy Use Intensity (TEUI) should not exceed 35 kWh/m2/year, and for all building types, the Thermal Energy Demand Intensity (TEDI) should not exceed 15 kWh/m2/year for space heating. Therefore, it is up to everyone to do everything in his/her power to preserve the environment in which future generations will live. It is critical to fully utilize digital technologies in this era of Industry by improving digital collaboration, implementing next-generation Building Information Modelling (BIM) as design and maintenance platforms, and transitioning to paperless projects from the office to the workforce (Outram, 2024).

There are challenges faced by construction companies who want to apply a sustainable strategy. In addition to the general perception that there is insufficient demand in the market, entry-level costs are another issue that worries many. Cost was cited as the top barrier to

adopting sustainable practices by about 40% of UK businesses surveyed about the topic. Moreover, 34% of customers stated that they preferred sustainable building practices, which makes it challenging for companies to strike a balance between customer demand and construction costs. Leeds (2017) stated that there is a turning point in the construction industry. However, businesses that don't take these challenges seriously will have a difficult time remaining viable. Because there are currently few entry barriers in the construction industry, there is intense competition in a crowded market. Profit margins are narrowing due to competition, which is also limiting necessary reinvestment in new technology and improved business procedures. Complicating this issue is stagnant labor productivity in the construction industry. The construction industry's productivity has stagnated over the past 50 years, while other industrial businesses have profited from a 100% increase in labour productivity. Construction offers more and more opportunities, but project complexity is also rising. Because businesses already have extremely narrow profit margins, one unanticipated production cost can completely wipe out profits for the entire organization. This issue is exacerbated by design complexity. Construction companies find it difficult to keep up with the growing size and efficiency requirements of designs. Only thirty percent of big projects in the energy sector are completed on schedule, and only fifteen percent of projects are completed within budget, according to a study by Accenture. Even worse, according to the 2015 KPMG Global Construction Survey, one or more underperforming projects were undertaken by more than half of all construction companies in the year prior. According to data from the Associated General Contractors of America (AGC), a majority of respondents, specifically 74%, felt that there was a shortage of skilled workers, and 53% stated that they were unable to recruit construction experts like engineers, supervisors, and estimators, the study maintains.

The construction industry is responsible for 25–40% of global carbon emissions. This level of use of natural resources is unsustainable and may jeopardize environmental protection in the name of development. The construction industry faces increasing challenges from two environmental issues: climate change and water management. Building energy in quickly developing nations like China and India will face significant challenges in meeting targets for the reduction of global carbon dioxide emissions. Although sustainable design and smart planning have the potential to lower pollution and energy use, they also call for a new method of project management, which the construction sector as a whole is not yet ready to adopt.

Like the transition from landline to cellular phone technology, the construction industry is at a turning point. The industry is being disrupted by digital technologies, which are opening up new ways to deal with issues like low productivity and profitability, project performance, a lack of skilled labor, and sustainability concerns. The construction industry is already undergoing digitalization; it is not a matter of if or when. Construction is becoming more industrialized, and using best practices and established manufacturing technology will help businesses increase margins and produce dependable results. Digitization will reduce waste, boost output, and lessen the negative effects of unanticipated on-site events. Nearly everything will change as a result of digitization, including the competitors and entry barriers. The ultimate outcome is an industry that produces more profitable and productive assets that are more sustainable. To stay ahead of the competition and embrace the digital future, construction companies need to act quickly to avoid falling behind (Ogunmakinde, Sher, and Maund 2016).

According to Lowe & Proverbs (2003), there is disagreement over the following: a thorough analysis of the financial concerns involved in creating and utilizing "green buildings"; a strong case for higher performance objectives based on human, environmental, and commercial factors; and the potential financial and performance gains from an integrated approach to design and costing. When evaluating the cost of green buildings, sustainable construction necessitates adopting a long-term perspective that accounts for both the initial and ongoing expenses. The main financial advantages of sustainable construction are increased building performance and durability as a result of lower maintenance and operating costs over the course of the building's life, as well as increased productivity due to the provision of an ideal living and working environment. But misconceptions about higher capital costs and an invisible market value deter contractors and developers alike. The integration of short-term market value and long-term benefits is crucial for driving demand for sustainable construction, according to this paper, which also examines the issues surrounding the cost and value of sustainable construction and analyzes its economic benefits and barriers. The building owner, the designers, and the construction teams must accept constraints and results in order to successfully achieve sustainability. Achieving sustainable construction is hampered by the lack of agreement amongst concerned parties, which is based on a rejection of sustainable limitation.

It was clear that one of the main barriers to adopting sustainable practices is the absence of reliable and consistent information about sustainable goods and solutions. The obstacle is not only knowledge per se; it is also the incapacity to disseminate knowledge via unambiguous documentation, such as contracts, drawings, and specifications. Based on our industry experience, it appears that there is a widespread perception that implementing sustainable construction would require more time. Even though this belief may be skewed or unfounded, it nonetheless exists. This is most likely due to a lack of expertise in the area and the time required looking into alternatives to conventional techniques and resources (Ayarkwa et al., 2022).

Among the most challenging problems facing the construction industry is the fragmented nature of most building projects. Since numerous suppliers, technical experts, and stakeholders may collaborate on a typical construction project, maintaining continuity and a common understanding of sustainability can be challenging. Organizations may have different priorities, and not all project participants may share a given party's dedication to sustainable practices and the environment. Concrete pollution has historically been one of the largest environmental problems the construction sector has to deal with. Large amounts of energy and water are needed for raw material quarrying, which also carries a risk of pollution and environmental harm. Significant carbon emissions from the production of concrete may also be a factor in long-term climate change. However, there is one area where advancements are significantly altering the industry—exciting new products that reduce carbon footprint are becoming available. For instance, the Walkie Talkie building in London was constructed to strict sustainability guidelines and received a "excellent" BREEAM rating. One of the most innovative features of the construction was the use of custom, low-carbon concrete. It makes sense that environmental issues are currently hot topics in both the building press and the general news. Whatever the focus of the media at the moment, the construction industry must continue to build on the solid foundations set nearly two decades ago by the UK government in order to pave the way for a future that is truly sustainable for all of us (Dr Tann, 2021).

In addition to the advantages that the construction industry offers, some of its operations have resulted in expenses, environmental issues, and some unanticipated negative effects where

larger goals are not always realized. The ensuing effects are a combination of those that can be directly linked to sector operations and others that are the result of a wider range of factors (like occupant behaviors). It is generally acknowledged that the industry must adapt to address environmental concerns as well as more general performance issues. Elmualim and Doğa (2016) reported that there has been a period of intense construction activity in North Cyprus recently. In 2003, the construction industry, which had previously primarily catered to domestic demand, experienced a notable surge in demand due to foreign buyers. Environmentalists have recently focused much of their discussion on this situation, which is unavoidably stressing the environment. North Cyprus, like the majority of other nations, is having trouble putting sustainable construction policies into practice at all levels. despite the fact that businesses and the government agree that sustainable construction is necessary. Not much is being done at the moment, and the regulations in place are not enforced. Moreover, there isn't enough public knowledge about sustainable building practices to be a motivating factor. This is mostly because, as is the case in most nations, the idea is relatively new to the construction industry. Furthermore, the political climate brought on by the Cyprus issue has always hindered progress and served as a barrier to adapting to new developments. However, there is currently a significant amount of superstructure and infrastructure construction taking place in North Cyprus. It is important to seize the opportunity to incorporate sustainability into the industry while it is still developing. However, there are some obstacles in North Cyprus's path to sustainable building. In North Cyprus, obstacles to sustainable building mostly coincide with issues facing the industry as a whole. According to a senior politician interviewed, the bulk of the issues stem from the current phase of development the nation is going through. This process is bringing to light the ongoing issues with the economy, laws, regulations, and every sector, both superstructure-wise and infrastructure-wise. The industry most impacted by these issues is construction, which is also the one that is growing the fastest. When most of these issues are combined with issues pertaining to sustainability, a number of obstacles are created that are difficult, if not impossible, to get past. The study discovers that before undergoing a thorough transformation, such as sustainability, the construction industry must find long-term solutions for its own enduring issues. Thus, it can be demonstrated that these issues impede the attainment of sustainable construction and hinder the industry's effective expansion (Baloi, 2003).

Lewis (2023) found that one of the hardest things for people to do can be to adjust to change. It is beyond question. Thus, the road to a more sustainable future is fraught with difficulties. Sustainable construction starts long before the contractors show up. From the initial stages of design and construction to continuous maintenance, all decisions should be made with sustainability in mind. A few of the novel strategies being investigated are robotic technology, active energy solutions, manufacturing techniques, platform systems, digital and data-driven processes, and manufacturing techniques. These will offer high-quality assets that add lifetime value and satisfy both present and future client and market demands in a quicker, less expensive, more environmentally friendly, and more efficient manner. Adopting digital technologies to offer assurance, efficiency, and performance feedback presents the largest challenge. In the past few years, digital disruption has increased in practically every industry. Even though the construction industry is one of the fastest-growing in the world, it has been among the last to adapt. One of the main advantages of the technologies is their potential to address several issues facing the construction sector, including labor shortages, productivity, safety and training, and collaboration. Industry workers' lives could be made better by these technologies, but there's also the question of whether their jobs will be threatened by them in the future. For those who have always done things a certain way, change is never easy. Because they love using their hands, construction workers frequently choose to pursue careers in this field. Furthermore, they typically favor adhering to conventional building techniques. As a result, businesses might find it difficult to implement new technology, and employee resistance effectively prevents technology adoption. Governance mechanisms, such as standardised work practises, monitoring, and reporting, are employed in projects to facilitate and protect communication amongst different stakeholders. To effectively control, articulate, and accomplish the project's goals, project governance defines, documents, and disseminates reliable and repeatable project practices. Control by itself, however, is unable to synchronize work in intricate interorganizational networks, such as industrial engineering projects. Building trust between various stakeholders is necessary to finish a list of tasks quickly.

Ayarkwa et al. 2022 declared that a thorough analysis of the literature was carried out in order to identify potential obstacles that project management teams may face when working on sustainable building processes. The review of the existing literature revealed several significant obstacles, including the increased expenses associated with sustainable building

practices and materials; the intricacies of the construction process; protracted bureaucratic procedures; insufficient knowledge of sustainable technology; and a deficiency of information on sustainable products. Sustainable construction is expected to cost between 1% and 25% more than conventional construction (Dwaikat and Ali, 2016; Wang et al., 2010). The complexity of the design layout, modeling, and green practices all contribute to the higher cost (Wu et al., 2019). According to Zhang et al. (2011, Zhang et al., 2011), using sustainable building materials is 3–4% more expensive than using traditional building materials. The project management team is impacted by the high costs associated with sustainable building because they are responsible for managing and completing their initiatives within a predetermined budget. Because they may involve intricate technologies and construction techniques, the processes involved in the construction of sustainable buildings may be unduly complex (Wu et al., 2019). The overall effectiveness of the project management team may be jeopardized if the intricacies of the construction processes are not communicated in a timely manner. Nevertheless, project management teams must successfully apply project management systems in order to meet the project's goals (Robichaud and Anantatmula, 2011).

According to Graeber (2015), the lengthening of the project completion period may result from the bureaucratic procedure needed to approve the use of contemporary technologies in building projects. Zhang and colleagues (2011), as well as Zhang and colleagues (2011), delineated the protracted approval procedures that project managers need to undergo in order to obtain approval for their construction procedures. There are numerous difficulties with this drawn-out approval, particularly for the project manager. According to Silvius et al. (2012), project management teams don't seem to know much about sustainable building practices and materials. Darko et al. (2018) emphasized that a project's overall performance and outcome are negatively impacted by a lack of familiarity with sustainable technologies. It is imperative for project management teams to guarantee that there is no deviation between planned and actual performance (Barbosa et al., 2021).

Although there is a conventional understanding of how a building should be built, many builders are reluctant to use sustainable building practices due to the associated risks (Kibert, 2016). Adoption of environmental auditing, a useful sustainable building technique, is

typically impeded by a lack of knowledge (Agyekum et al., 2019). Due to a lack of sustainability studies, particularly on topics related to indoor environmental quality, productivity, and occupant health, there is also insufficient public education regarding the benefits of sustainable construction (Darko, 2019). According to Opoku et al. (2019b), one of the main issues with sustainable building practices is a lack of awareness. Project management teams face difficulties due to a lack of sustainable product information regarding sustainable materials and the sustainable construction process that is necessary to understand in sustainable buildings (Schöggl et al., 2017; Häkkinen and Belloni, 2011). Builders are always forced to deal with experts who possess this kind of knowledge. The risks associated with the various contract forms of project delivery, communication issues, member interests in the project, and the additional time required to enforce sustainable building practices on construction sites are some of the other challenges that have been identified (Koolwijk et al., 2018).

According to Oğuz et al. (2024), the construction industry is largely responsible for both contributing to and mitigating the effects of climate change, making it the most pressing and intricate environmental issue of today. The building and construction industry is responsible for 39% of the world's energy-related carbon emissions and 36% of final energy use, according to the World Green Building Council. The industry must attain net-zero carbon emissions by 2050 in order to comply with the Paris Agreement's recommendation to keep global warming to 1.5°C. It follows that low-carbon strategies must be implemented by construction managers at every stage of the building life cycle, from design and material selection to construction and operation to demolition and reuse. Utilizing renewable energy sources, increasing energy efficiency, lowering embodied carbon, and strengthening carbon sequestration are a few of the tactics. Confronting climate change in the building industry requires diversified approaches. In addition to energy efficiency, other important factors include water conservation, biodiversity preservation, circular economy concepts, and sustainable materials. Comprehensive environmental responsibility is ensured through cooperative efforts with scientists, suppliers, and local communities. Future developments in the industry will be determined by innovations in design, construction, and materials. Maintaining the fragile ecosystems of our world and working toward net-zero goals are essential to balancing environmental challenges. Another significant user of natural

resources, including wood, minerals, land, and water, is the construction sector. The industry uses 12% of the world's freshwater resources and 40% of its material resources, according to the United Nations Environment Programme. Furthermore, as the world's population and urbanization rise, so is the demand for these resources predicted to grow. Because habitat destruction, soil erosion, water pollution, and biodiversity loss can result from resource extraction and depletion, this poses a serious threat to the environment. Therefore, in order to minimize the use of virgin materials, maximize the use of recycled and renewable materials, optimize the use of water and land, and avoid waste generation, construction managers must implement resource-efficient strategies, the study advises.

Significant biodiversity losses are occurring in the construction industry as a result of environmental changes. Clearing land for construction projects frequently involves disturbing natural habitats and uprooting wildlife. Temperature fluctuations and modified precipitation patterns also add to the instability of ecosystems. Pollination, soil fertility, and overall ecosystem resilience can all be impacted by biodiversity loss, which can have a domino effect on ecosystems. The building sector is facing the effects of climate change, and protecting biodiversity is becoming more and more important as a component of sustainable and ethical development. During the building process and at the end of the building life cycle, the construction industry is also a significant source of waste generation. The World Bank estimates that the industry produces 2.01 billion tonnes of waste from construction and demolition annually, or 36% of all waste produced worldwide. This waste can contaminate soil and water, increase greenhouse gas emissions, and take up valuable land space, among other detrimental effects on the environment. Consequently, waste hierarchy-based waste management strategies—reduce, reuse, recycle, recover, and dispose—must be implemented by construction managers. Recovering energy from waste, diverting waste from landfills, separating and sorting waste on site, and designing for deconstruction and adaptability are a few of the tactics. Construction waste is horrifyingly abundant, not just the waste produced on the spot. Every stage of the process, from the original concept design to operations and end of life, involves enormous amounts of waste. What proportion of design iterations, planning applications, tenders, etc. are thrown away? How much time is spent making sure compliance by checking the process or checker? We must completely reevaluate the entire construction process if we are to begin becoming efficient. By comprehending the desired

results from stakeholders, the design is lean from the beginning. It ought to take less bidders to evaluate tenders based on value. There ought to be less waste generated on site when offsite construction is used to complete projects. The largest obstacle still stands, though: how to inspire and educate the crews to maintain good hygiene and implement separation procedures. All contracts contain provisions that allow for monetary fines and assign responsibility to the contractors. A deadline for mitigation is set when non-compliance is detected and photographic proof is shared on the project chat. Due to its potential to disrupt the natural habitats and ecosystems of numerous plant and animal species, the construction industry is another significant contributor to the loss of biodiversity. Over a million species are in danger of going extinct due to human activity, which has changed 75% of the land surface and 66% of the ocean area. Given that biodiversity supports vital ecosystem services and functions like pollination, pest control, water purification, and climate regulation, this could have detrimental effects on the ecosystem. Therefore, in order to avoid or minimize the effects of construction activities on natural habitats, restore or enhance the ecological value of degraded areas, and create or support green spaces and corridors, construction managers must implement biodiversity-friendly strategies (Schöggl et al., 2017).

The built environment and construction are often to blame for the decline in biodiversity. Development of land too frequently has an unavoidable negative impact on biodiversity, destroying habitats, ecosystems, and food sources, and occasionally leading to flooding, water depletion, air and water pollution, and disturbances in river flows. A 10% BNG is required in the UK under the new Biodiversity Net Gain (BNG) requirement (2021 Environment Act). Developers are required by the National Planning Policy Framework to follow a "mitigation hierarchy" when choosing how to deliver BNG. The loss of biodiversity must first be minimized or reduced on the spot. In situations where on-site compensation is not feasible or the project's viability is compromised, developers can purchase Biodiversity Units from organizations like the Environment Bank. New construction and major renovations must have more biodiversity after construction activity than before; * Construction materials must be sourced so that they have no detrimental effects on biodiversity; * A universal metric must be established to actually measure biodiversity so that everyone is talking about (and enhancing) the same thing (Feraday, 2022).

The construction sector bears accountability not only for the ecological consequences of its

operations, but also for the social effects on the communities and stakeholders that it involves. About 7% of the world's workforce is employed in this industry, which the International Labour Organization estimates faces issues with human rights, decent work, and workplace health and safety. Those who live in or close to construction sites may also experience changes in their standard of living, wellbeing, and culture as a result of this industry. Thus, it is imperative for construction managers to implement social responsibility strategies that uphold and safeguard the rights and welfare of employees, clients, suppliers, and residents; they should also involve and consult with these parties at every stage of the project to guarantee that the construction project's results are inclusive and beneficial to all (Mazur, 2023).

According to a Mahamud (2019) study, the following sustainability issues are currently plaguing the construction sector.

Unsustainable building: Due to its size, complexity, and fragmentation, this industry frequently deals with issues like overspending, increased costs, and negative effects on the environment, society, and economy. A successful and sustainable project must be finished on schedule, within budget, and without endangering the economy, society, or the environment. When the construction industry faces these issues, it can no longer be sustained.

Overrun of time: A construction project's success depends on its completion within the allotted time. But this kind of success is not always attained. According to a study, of 3,407 projects in Nigeria during the study year, less than 1% were finished on time, 44.5% were delayed, and 53.5% were abandoned. It was discovered that the minimum average percentage escalation period for projects in Nigeria was 188%. 51.40 percent of projects were delayed, according to a similar study on the challenges of sustainable construction in developing countries that was carried out in Bosnia and Herzegovina. According to Jamilus et al. (2013), 82% of projects in Jordan, 70% in Ghana, 70% in Saudi Arabia, and more than 70% of projects in Malaysia experienced time overruns.

Cost overrun: It is regrettable to report that a significant fraction of construction projects globally, predominantly in developing nations, do not come in under budget. In the construction industry, cost overruns are a very prevalent and undesirable issue. According to

Azhar et al. (2008), there is even a 100% prediction of cost overruns in developing nations. According to various studies, 33% of projects in the UK's construction industry resulted in cost overruns; however, this percentage was significantly higher in developing nations, with the UK accounting for 51% of such cases in Uganda, 81% in Croatia, 58% in Malaysia, and 58.67% in Bosnia and Herzegovina (Jamilus et al 2013).

According to Flyvbjerg's research, 90 percent of construction projects worldwide experience a 50–100% cost overrun (Flyvbjerg et al, 2003). The primary causes of cost overruns have been determined to be a lack of implementers' experience, inadequate management and supervision on the job site, inaccurate time and cost estimates, poor scheduling, frequent design modifications or changes, fluctuating material prices, etc. consequences of building The majority of construction industry activities have been found to pose a very serious risk to the environment, either directly or indirectly. However, their effects on society and the economy are also not insignificant. In the past, human development was the primary focus of the building industry in developing nations. The biophysical environment has not been adequately taken into account. But with the majority of developing nations experiencing severe environmental degradation in recent years, environmental neglect is no longer acceptable.

Environmental impact: Because developing nations are still expanding and on the verge of meeting the growing demands of urbanisation and industrialization, they are found to have a greater environmental impact from the construction industry than developed nations. This industry has serious negative effects on the environment, including pollution, resource overuse, and massive waste production.

Degradation of the environment: Building uses a lot of natural resources and generates a lot of pollutants. Due to the significant risks it poses to the environment, it is regarded as one of the least environmentally friendly human activities. Environmental protection is lacking from the majority of construction sites (Rodman and Lenssen, 1994). By releasing CO2 into the atmosphere and hastening the destruction of forests for building, construction contributes to severe climate change and global warming. Twenty percent of the yearly Challenges of Sustainable Construction in Developing Countries are found to be related to the production of iron, steel, cement, glass, lime, and bricks. An additional one percent of dioxin emissions are attributed to asphalt each year (UNEP, 1999). Serious environmental degradation is caused

by over-quarrying for raw materials, making cement and binders, using hazardous chemicals in materials, and using water wastefully. Ecological collapse will result from construction that does not properly take into account the preservation of non-renewable energy, minimising environmental impact, and conserving natural resources.

● **Overuse of resources:** This sector is known for being the biggest user of natural resources. 15%–20% of the freshwater withdrawals made worldwide, 30%–40% of wood, 40%–50% of natural aggregates, and approximately 40% of energy flows are consumed by it. Natural resources around the world are being depleted as a result of this massive consumption and rising demand. Building construction and maintenance account for about 10% of the world economy and require about 40% of the world's resources and energy (Shen and Tam, 2002).

● **Massive waste generation:** An excessive amount of waste is produced, which lowers productivity, wastes materials, delays the completion of projects, and loses a substantial amount of money. According to a study, 30–35% of a project's production costs are wasted on site, and only 9%–10% of materials are used. Construction and demolition waste makes up 13–30% of all solid waste dumped in landfills worldwide. In developing nations, this ranges from 25% to 35%.

The main causes of the rising waste generation in developing countries that are rapidly urbanising are frequent design changes, low-quality materials, worker negligence, poor planning and design, poor site management, poor supply chain, incompetent material use, weather effects, etc. (Bossink and Brouwers, 1996). Most of the time, illegal dumping occurs with the intention of maximising profit by avoiding the cost of transportation and payment to the authorised landfill, which poses risks to human health and the environment.

● **Impact on society:** With 111 million workers, 74% of whom are in developing nations, the construction sector is one of the global employers with the strongest ties to society. With this enormous employment, only 23% of the world's construction output is produced globally; this suggests that developing nations have higher "employment intensity" (ILO, 2001). Therefore, the sector has the potential to significantly contribute to human development and raise the standard of living for the underprivileged. Nevertheless, this industry gained a reputation for unethical labour practices, corruption, avarice for profit, and environmental damage, just like other development industries. The International Labour Organisation (ILO)

reports that sexual harassment and gender discrimination, poor safety records, and numerous other issues are linked to the developing world's construction sector. Because of this, most people who work in construction do so out of need rather than choice, which call into question the industry's social response (ILO, 2001).

● **Economic impact:** Up to 10% of the world's GDP is made up of the construction industry. Additionally, the sector supports micro, small, and medium-sized businesses (SMMEs). 90% of those working in construction are employed by small businesses. The environmental impact of the construction industry is closely linked to its economic sustainability. The construction sector can be more economically efficient and have a smaller negative environmental impact by employing least-cost building techniques that require the least amount of resources and produce the least amount of waste. For this industry to be economically sustainable, social and environmental costs must be internalised and reflected in the cost of the finished product (UNEP, 2002). The report maintained that developing nations are starting to think about how to handle these issues as they are facing more significant issues in other development sectors, even though developed nations have already made some headway in addressing and overcoming the sustainability challenges in the construction sector. The author indicated that the following are typical obstacles to future sustainability in construction:

● **Internalising:** In the construction industry, sustainability is still a relatively new idea and is not yet a crucial component of business operations or decision-making processes. All business and development decisions are not driven solely by sustainability; rather, it is a secondary expectation.

● **Profitability:** It's widely believed that adopting sustainable building practices will result in higher initial and ongoing expenses as well as lower marginal profit. Instead of making long-term investments for greater achievement, additional investments in machinery, equipment, training, and better employment conditions are seen as a reduction in loss or profit. The task at hand involves identifying methods to reduce expenses by optimising resource utilisation, enhancing productivity, mitigating risks, and realising the advantages of sustainability in order to boost profitability.

● **Resource mobilisation:** One of the main issues facing sustainable construction is the mobilisation of resources to support scientific research and technological advancement. Resources can be mobilised and directed towards sustainability by governments, the commercial and academic sectors, universities, and research organisations worldwide.

● **Public awareness:** Citizens' involvement and awareness are crucial for sustainable construction, as are the governments and the construction industry. Citizens must be aware of the advantages and opportunities associated with using environmentally friendly building materials and products, as their involvement is essential to changing resource consumption patterns.

● **Enhancement of quality:** Improper and ineffective building procedures waste natural resources and endanger both employees and consumers. A first step towards sustainable construction can be Quality Improvement of Construction Process and Products along with enhanced safety Challenges of Sustainable Construction in Developing Countries.

● **Cutting down on resource usage:** The construction industry has made cutting down on resource usage a top priority. There are several direct and indirect ways to achieve this, each with unique challenges: Minimising the wastage of building materials, utilising recycled waste as building materials, implementing high energy efficiency in buildings, conserving water, and ensuring durability and upkeep.

● **Innovative building materials and techniques:** By using resources in a balanced manner, sustainable construction can significantly improve socioeconomic and environmental sustainability on a global scale. According to a recent study, the EU would need to cut its consumption of cement by 85%, steel by 87% and aluminium by 90% if it were to only use its fair share of the world's resources (Hille, 1997). Large-scale reductions in greenhouse gas emissions are another requirement of the Kyoto Protocol. In order to address the need to reduce pollution, new design concepts are needed, similar to how the early 20th century saw a shift from brick and mortar to steel and glass.

● **Environmental health and safety:** A significant portion of the world's toxic load is attributed to construction materials. Therefore, more investigation is required to fully understand how construction materials and site operations affect the environment and human health. In addition, new approaches must be implemented to deal with dangerous materials like finishes and asbestos.

● **Procurement:** The clients' involvement is frequently a major factor in how sustainable a construction project is. Sustainable construction can be facilitated by incorporating sustainability standards into the procurement policies and procedures of all major clients, including the government, end users, and market stakeholders.

According to ILO, (2001), the following are the main barriers to sustainability:

● **Insufficient capacity:** One major issue with construction industry is its insufficient capacity. Professionals, craftspeople, and workers with the necessary training to handle sustainable construction are insufficient. The majority of the construction industry in many developing nations struggles to meet the demands of regular construction and must occasionally hire workers from outside their country. The construction industry has extremely low levels of skill retention and training due to the highly mobile nature of its workforce.

● **An unstable economy** is characterised by a rise and fall in construction projects in direct proportion to changes in income, especially in developing nations. The implementation of sustainability is greatly influenced by the stability of the government and all stakeholders (Wells, 2001).

● **Poverty and insufficient urban investment:** Developing nations must accommodate rapid population growth while having limited resources to invest in urban development. As a result, the quality of urban life and the surrounding environment declines more quickly. It becomes exceedingly challenging to adapt alternative building processes and concepts using cutting-edge, sustainable technologies when resources are limited.

● **Unstable economy:** Building projects fluctuate in value in tandem with income, especially when the economy does, as is frequently the case in developing nations. Every stakeholder and governmental stability has a significant impact on the implementation of sustainability. For instance, the recession caused Kenya's public building activity to drop to only 3% of what it had been in 1982 (Wells, 2001).

● **Poverty and insufficient investment in urban development:** Developing nations can afford to invest little in urban development, but they also have to deal with rapid population growth. The quality of urban life and the surrounding environment declines more quickly as a result. With such limited resources, it becomes extremely challenging to adapt alternative construction processes and concepts with the newest and sustainable technologies.

● **Negate the sustainability issue:** Suppliers, clients, regulators, and other stakeholders in the construction industry generally disregard the sustainability issue. For different stakeholders, neglecting biophysical sustainability has different consequences.

● **Politicians:** agenda-differentiation in leadership, unless there's a clear correlation between poverty and gender.

● **Manufacturers:** product specifications, marketing, and materials.

● **Governing authorities:** Inattention to land use, subdivision, or plan approvals.

● **Professionals in the environment:** establishing standards or design criteria and offering instruction. The lack of interest in this regard can be attributed to its accessibility to a wide range of income groups as well as the absence of alternative economic and credit mechanisms that could facilitate changes in current practices (Chris, 2012).

● **Technological laziness:** The majority of developing nations still employ colonial-era technologies and procedures. It is not expected that developed countries will blindly adopt the concepts, codes, and specifications of developing nations, as their capabilities and nature in this area are entirely different. To ensure the greatest and most sustainable use of their own resources, developing nations must adapt new and specialised knowledge and technology. Following significant fire incidents in 1826, traditional planning and construction methods utilising wood have been discouraged in Malaysia. Even though earth construction is a long-standing practice in South Africa and more than 10% of the population lives in earth housing, the country strongly discourages traditional earth construction (Chris, 2012).

● **Lack of integrated research:** There is a lack of integrated research in planning and building technologies. Organisations and research institutions handle each issue independently and separately. Organisations that deal with building technologies concentrate on particular technologies, such as strengthening materials, while other organisations concentrate on issues like pollution, transportation development, the environment, or social impacts. Because there is a lack of integrated work between these agencies, development activities do not proceed as planned. It is also uncommon to find funding for integrated research projects as opposed to those that concentrate on a single characteristic, like energy

competence. According to the study, both developed and developing nations urgently need sustainable construction practices. Achieving sustainability in this sector is hampered by a number of issues in developing nations, including political and financial instability, a lack of awareness, and numerous other issues. The construction industry, its stakeholders, and clients in both developed and developing nations are unaware of this and believe that minor adjustments to resource efficiency and the construction process will suffice. In order to give them time to develop, acknowledge, and put into practice a robust sustainability ideal of development with its corresponding morals and ethics, the majority of the technologies and concepts being adopted are merely stopgap measures.

2.6.1. Overcoming Sustainability challenges and design for a sustainable future

Regular communication on sustainability practices, updates on project progress, and establishing incentives for participation are some ways to solve these issues (Deniyi; Mohamed, & Rasak 2020). Understanding the present performance and recognizing your strengths and shortcomings will help to solve sustainability difficulties. life cycle assessment (LCA), carbon footprint analysis, or sustainability reporting standards can be used to measure and report the environmental and social impacts. This will help to benchmark personnel performance against their peers, industry standards, and best practices, and to prioritize the improvement areas (Mashwama; Thwala; & Aigbavboa 2019).

To design for a sustainable future, a lot of effort and dedication is needed, and this calls for Self-education (Wamsler 2020). Many have fortunately developed courses with that in mind. When protecting the planet from a collapse in the economy, ecology, and society, technology plays a significant role. It is believed that further solutions will soon be developed because technologies like renewable energy and electric vehicles are unquestionably game-changing (Lupp et al. 2021).

One more sustainable design challenge that needs to be addressed is the data centers that are used globally to support a wide range of small and large tech activities, such as cloud storage. To sustain daily operations and IT infrastructure, a massive amount of energy is needed. For instance, the energy required to train a single chatbot consumes more than 100 homes' worth of energy annually, making artificial intelligence the most energy-intensive computing

technology. The majority of energy produced is lost as heat from hardware components, necessitating the use of more energy-intensive cooling systems to maintain system functionality. One way to address this is to host cloud operations in areas where a sizable portion of electricity is generated by renewable energy sources rather than fossil fuels. For instance, Google Cloud states that it runs "the cleanest cloud in the industry" and provides information on the percentage of energy that is carbon-free and carbon-intensive by Region (Mazur, 2023).

.

Create an Innovative Culture: Businesses in the construction industry must cultivate an environment that values creativity and rewards original thinking. This can be accomplished by forming specialised innovation teams, offering ongoing training programmes, and working with researchers and industry experts. To increase productivity and efficiency, construction managers should give digital transformation top priority. Using Internet of Things (IoT) devices, cloud-based project management systems, and BIM can transform the construction sector and improve stakeholder collaboration. Successful project execution depends on effective collaboration and communication amongst all stakeholders. The problems of disjointed processes can be solved by putting in place digital platforms and tools that promote real-time collaboration, data sharing, and information transparency (Chan et al., 2017).

By providing grants, incentives, and tax breaks for businesses that invest in sustainable practices, governments can significantly contribute to the innovation of construction management. With this support, the financial barriers to implementing cutting-edge technologies may be surmounted. To stay up to date on the newest developments and optimal techniques, construction professionals should take an active part in industry conferences, workshops, and knowledge-sharing networks. Within the industry, sharing experiences and lessons gained can foster innovation and ongoing progress. Opportunities for employee engagement must be provided if the staffs are to be engaged. Allowing employees to participate in business initiatives and have some autonomy will help them feel more connected to the company and will also help them feel more purposeful. This aligns with the recommendations of experts for involving employees in sustainability initiatives. Creating a green team is one of the best ways to accomplish this (Channell, 2023).

Sustainability is not supported by company culture. To get around it, this typically shows when a company's sustainability efforts are being considered by a small percentage of its

employees. First and foremost, gaining management support is essential as it will give lower-level staffing members the impression that they are supported from above. Secondly, you will have to make sustainability an enterprise-wide project by extending it beyond a single department. Additionally, this will support worker engagement. Finally, education is crucial. Employee sustainability training can have a big impact, and more of the businesses. Although it takes time to change a culture educating and motivating the staff will give the right path to start (Wu et al., 2019),

According to Ahadzie (2007), despite the concept's high initial cost, educating stakeholders about the long-term advantages of green buildings could improve its implementation and lessen the difficulties project management teams face when implementing sustainable building practices (Opoku et al., 2019a). According to Simpeh and Smallwood (2015), a lack of knowledge about the complete range of advantages that sustainable practices can provide, particularly in developing nations, makes people less willing to invest in them. Wu et al. (2019) believed that project management teams would have an easier time persuading stakeholders to adopt green and sustainable building practices if they provided training and education.

Green building experts must be consulted from the start of the construction project due to the intricacies and financial implications of the sustainable building process (Wu et al., 2019). According to Nduka and Sotumbo (2014), investing in sustainable buildings benefits both consumers and buyers while also creating opportunities for other industry stakeholders. The survey's experts also concurred that project management teams would face fewer difficulties when collaborating with a group of specialists who are familiar with sustainable building practices and have experience with green buildings. An expert team like this could contribute their unmatched expertise to the project, reducing waste and rework while providing outstanding recommendations on material selection, energy efficiency, and operational efficiency during construction (Hwang et al., 2016).

Prioritising and establishing sustainable objectives early in the feasibility study

It is imperative to implement key sustainable principles from the project's feasibility stage onwards to ensure the sustainability of construction projects (Darko, 2019). This is due to the fact that modifications to the construction drawings, the selection of materials, or even the procedures and ideas to be used for the building at this point have little to no financial ramifications (Wu et al., 2019). Setting sustainability goals could also help project

management teams make better decisions and take more initiative when presenting and completing projects within predetermined budgets (Zhang et al., 2011a, Zhang et al., 2011b).

The concept model illustrates the primary obstacles faced by project management teams in relation to four essential elements: technological maturity, competency, cost, time and safety, and documentation. When implementing sustainable building practices, project management teams encounter a variety of difficulties, all of which are covered by these four essential elements. The four primary elements are the collective terms used to categorise the difficulties encountered in sustainable construction processes (Darko, 2019; Djokoto et al., 2014). The study also identified 16 mitigation strategies that, if implemented, could help remove the majority of the obstacles and facilitate the adoption of sustainable building practices by project management teams in the developing world's construction industry. In order to guide project management teams towards a sustainable building process, these mitigating strategies are essential. One excellent method of determining a building's level of sustainability is to measure the different effects of sustainable construction. Measuring energy outputs and the effectiveness of eco-friendly technologies allows us to assess the true effectiveness of a green building. It will be easy to determine whether the buildings are truly net-zero by doing this. Even with the obvious advantages of sustainable building, some developers and construction workers continue to be sceptical. There is a common misconception among those who detest change, think that implementing sustainable features will be too expensive, or are ignorant of the pressing climate issues that are currently facing the society.

There will always be a construction site whether constructing a brand-new skyscraper or making sustainable modifications to an existing building. While making building modifications to boost sustainability and energy efficiency is a great first step towards a sustainable future, there is also a need to be aware of the impact on construction sites. By using less energy, managing waste properly, and recycling waste when it can be done, a sustainable construction site environment could be created. By installing a silt fence, also known as a filter fence, to preserve the quality of the surrounding environment while construction is underway, sustainability can further be promoted on-site (Zhang et al., 2011).

Recognizing the strengths and weaknesses and understanding the current performance is the first step towards conquering sustainability challenges. To measure and report environmental

and social impacts, a variety of tools and frameworks, could be used, such as sustainability reporting standards, carbon footprint analysis, and life cycle assessment (LCA). This will assist in prioritizing the areas for improvement and in comparing the performance to that of the peers, industry standards, and best practices. The next stage is to formulate the goals and vision for sustainability and convert them into SMART goals—specific, measurable, achievable, relevant, and time-bound. The Sustainable Development Goals (SDGs) of the United Nations can be used as a guide to help align the objectives with the business plan, stakeholder expectations, and legal requirements. Along with regularly monitoring progress, also make sure that all internal and external stakeholders are aware of the goals. The absence of buy-in and engagement from stakeholders is one of the most frequent obstacles to the implementation of sustainability. Involve staff, clients, suppliers, investors, authorities, and local residents in the sustainability endeavours, and attend to their needs and concerns. To get their opinions and co-create solutions, a variety of techniques like partnerships, workshops, feedback sessions, and surveys can be used to get their opinions. It's important to acknowledge and honor their accomplishments and contributions, as well as cultivate a sustainable culture within the company. Implementing sustainability can also be challenging since it requires innovation and process, product, and service optimization to cut down on emissions, waste production, and resource consumption. Lean manufacturing, the circular economy, and green chemistry are just a few of the strategies that can be employed to increase productivity, quality, and profitability while lowering the negative effects on the environment and society. It is advisable to investigate novel prospects like sustainable energy, biodegradable packaging, or plant-based substitutes in order to set apart from the rivals and satisfy evolving customer needs. To overcome sustainability challenges, cooperation and mutual learning are the last steps. To exchange best practices, problems, and solutions with other food manufacturers, join trade associations, networks, or platforms like the construction Industry Sustainability Strategy, the Sustainable construction Systems Programme, or the construction Waste Reduction Alliance. There is also a need to pick up tips from industries that have successfully implemented sustainability initiatives, like fashion, electronics, or the automotive industry. To get through any operational or technical challenges, outside assistance from mentors, experts, or consultants can also be considered (Oguntona et al., 2019).

According to Feraday (2022, the following strategies can be used to overcome sustainability challenges: Increase transparency by using analytics and insights in manufacturing. Enhanced

communication and increased availability of suppliers, particularly those nearer the manufacturing sites, make use of the RDLs, or regional data libraries, Cloud collaboration with accurate, real-time data throughout the product lifecycle. Although it may initially cost more, sustainability will ultimately result in lower carbon footprint costs and fines. Identify a business that offers systems, products, and services for commercial and retail lighting. To create a more sustainable business, take on sustainability challenges head-on. Adopting a supply chain traceability and transparency policy is the initial step in resolving concerns regarding obstacles to attaining sustainability goals within supply chains. Initiate change in the business by fostering accountability and being transparent with stakeholders and customers about the location and method of production of goods. By using purchasing power with suppliers, the sustainability of the value chain could be increased. Make an effort to collaborate with the corporate partners and suppliers to make sure they can carry on offering goods and services that help achieve the sustainability objectives. Building a network of regional providers is another thing to think about when trying to shorten the value chain's distance.

Tafazzoli (2017) found that significant changes, adaptations, and modifications should be made to the traditional methods in order to maximize the sustainable built environment. It is challenging to make these changes in a setting where decisions are hampered by budgetary and schedule constraints and environmental concerns are not always significant to all parties. Furthermore, if these efforts are disjointed, these modifications won't be successful (Alarcón, 1997). Project managers are crucial in helping to implement sustainable construction practices, as stated in overcoming the project management challenges (Shen et al., 2010). Choosing construction manager who possesses green building expertise will help. An essential component of a sustainable construction project's success is the construction manager's knowledge and proficiency in adhering to sustainability guidelines. This is especially important for projects that do not seek a sustainability certificate because the construction team is not provided with a list of specific guidelines to adhere to. Not every sustainable construction technique calls for an additional financial outlay. The project can be built more sustainably without needing more funding if the construction manager is knowledgeable about how to increase sustainability during construction. For instance, efficient scheduling (avoid noisy tasks during certain hours) and low-cost measures can be used to control dust and noise during construction.

Alarcón, (1997) maintained that Green projects have higher start-up costs, and the project manager will have a harder time advancing the project toward significant completion within reasonable budgetary constraints. This underscores the importance of choosing the right construction manager. The importance of taking into account a project manager's knowledge and expertise in green construction is frequently overlooked because traditional methods of choosing project managers primarily rely on an individual's experience. The process of making this decision should be changed to include choosing construction managers with sustainable construction certifications, sufficient experience, and involvement in environmentally friendly projects. Modifying and adjusting traditional construction management techniques. A variety of steps must be taken in order to implement green construction, including feasibility studies, site analysis and selection, budgeting, scheduling, hiring staff, bidding, contracting, and inspections. Further technical considerations, material selection, demolition and restoration techniques, and material waste-management plans are also necessary for green construction. It is challenging to apply all of these different practices using the traditional techniques and methods of construction management. As a result, one of the biggest obstacles to building green is the need to implement new policies that must create an environment where all choices made during the design and construction process are focused on reducing the negative effects on the environment and improving the health and well-being of communities and occupants. Obtaining various sustainability certifications is a useful approach to managing green construction once a project manager with significant experience and knowledge in sustainable construction has been hired. To be eligible for these certificates, there is a need to meet performance requirements at various project levels by earning specific scores. Based on how various metrics contribute to the triple bottom line of sustainability, scores are established. This implies that if a project is more sustainable the higher its score. Each rating system offers a comprehensive set of requirements along with guidelines and instructions, many of which are related to project management, in order to attain these scores, the report disclosed.

Shen et al., (2010) noted that a project can be set on the correct track and a lot of adjustments to the traditional methods of implementing green practices can be handled by trying to obtain these certificates. Many construction projects currently have an environment where risks are transferred to other parties. As a result, the process becomes linear and divided, with each party attempting to protect its own interests in the project. With the collaborative approach, on the other hand, decisions are made collectively and teams are able to effectively

communicate their concerns in order to come up with solutions. The project is viewed as a system in which each member's success or failure is attributed to all members. Another necessary modification to the traditional managerial aspects of construction projects is the maximizing of integration, which is where project management comes into play. Contracting rewards sustainability, the report indicated.

Bonuses and awards for projects that use sustainability practices are another way to encourage their application. There are several ways to do this: the contractor can reward its subcontractors; the owner can reward the contractor or consultant; the construction manager can do the same; or the government can reward the owners. The parties involved will determine the kind of rewards that are given. Two potential solutions at the government level are to facilitate permits and take into account various tax reductions. Although it is widely acknowledged that putting sustainable construction policies into practice will increase initial costs (Yudelson, 2008), especially because green materials will cost more (Kibert, 2008), there are important considerations that must be made in order to understand why building green can be both environmentally friendly and economically advantageous. Commonly, life-cycle energy savings make up for higher initial costs. Furthermore, compared to conventional building units, green properties are currently producing faster leasing and sales (Yudelson, 2008).

The fact that the benefits of this investment are not split equally between the builder and the tenants is a major obstacle to willingness to invest more in green building (Yudelson, 2008). The developers bear the bulk of the increased expenses associated with green buildings, while tenants will primarily benefit from lower energy and water bills and improved indoor environments. For the majority of project owners, the primary deterrent to going green is the higher upfront costs. Persuading project owners to increase their expenditure for environmental purposes can be challenging, particularly in private projects. Increasing investor awareness of the value of taking life-cycle costs into account in addition to initial costs is a major driving force behind the decision to go green. In contrast to a study of 146 green buildings that found an actual average marginal cost of less than 2%, respondents to a 2007 public opinion survey by the World Business Council for Sustainable Development believed that green features added, on average, 17% to the cost of a building. It's critical to remember that, for the majority of developers, cutting initial expenses is more significant

than cutting ongoing expenses. Nonetheless, one of the most important things that drives developers is a clear picture of the savings that come from using green building techniques. In order to make this happen, designers and construction managers play a critical role. One suggested tactic is to prepare several scenarios for the degree of greening and a trustworthy estimate of the anticipated savings from carrying out each scenario. Given that financial incentives have a greater effect; developers are more likely to agree to bear higher upfront costs if they are certain that their investments will be repaid. Furthermore, when estimating the additional costs associated with green construction, investors might make incorrect assumptions. A prevalent concern that has been identified as the primary source of numerous issues during the design and construction phases is the absence of efficient communication and collaboration among team members. When there is insufficient communication between the experts involved, they make decisions based on their own procedures, guidelines, and industry standards (Sappe 2007).

Implementing sustainable strategies is a common goal that the project can only successfully accomplish if all members of the construction team work together and contribute to the process. To achieve this, team members must effectively communicate with one another and make decisions that will keep the project headed toward sustainability for the duration of its existence. Put differently, the decisions and actions of various experts and personnel should not lessen or negate the impact of other people's efforts, nor should they divert the project from its intended course. Forming a comprehensive understanding of the project's initial and ongoing costs requires effective communication. Subcontractors' propensity to complete tasks more quickly may have an impact on the caliber of this communication. Effective cost decision-making is difficult to achieve without a professional expert on the team who can facilitate this communication and who can also bring in experts to provide operational cost estimates under various scenarios, especially in upfront planning. Effective regulations are necessary for the sustainable construction industry to succeed for two main reasons: 1) since sustainable construction is still a relatively new concept, the laws governing it should be improved and filled in as it becomes more established in order to support the environmental movement. 2) Given the importance of advancing the green movement, it is necessary to enforce the implementation of its core principles, as minimising the built environment's effects cannot serve as a significant incentive for investors (Ekins & Zenghelis, 2021).

While there are common interpretations of terms used in sustainable construction, such as "efficient/green building," there isn't a single, widely recognized definition for "green building" that conveys the same idea (Robichaud et al., 2010). This presents a challenge for expanding the green building concept. Similar to this, it would be challenging to track and adhere to sustainability goals in construction without precise change indicators, a framework, and tools for measuring performance. Individual interests would also play a role in this. The core concerns of sustainability should be covered by building rules, codes, and regulations in order to solve this issue. According to Singh et al. (2009), the indicators and composite indicators are helpful tools for policymaking in areas like the environment, economy, society, and technological development. The enormous complexity of our dynamic environment can be reduced to a manageable amount of meaningful information by using quantitative indicators to summarize, focus, simplify, quantify, analyze, and condense the information (Godfrey and Todd, 2001). Remember that new standards are more likely to be adopted successfully when they are more readily assimilated into conventional practices, which is especially important when overcoming technical obstacles to green construction implementation. Put another way, rather than implementing brand-new strategies and tactics, this shift ought to be based on improving established ones. Furthermore, the implementation of stringent standards and unrealistic expectations will have a defying effect on this paradigm shift. One of the biggest obstacles (apart from additional costs) to choosing to voluntarily follow green building codes and sustainable construction practices is complex legislation that can discourage developers and result in codes that are specific to green buildings (Architecture Week, 2001 & Huang et al., 2012). As a result, it is necessary to confirm the practicality of new regulations by reviewing project feedback before implementing them.

Encouraging green practices to be used in public projects has the following benefits:

Because public projects typically face less financial constraints, they can take into account more expensive but more sustainable design elements, like rainwater storage facilities and net-zero buildings that include living buildings and solar panels, the report indicated. This opportunity may inspire other investors to demand more environmentally friendly and sustainably constructed buildings. Public buildings are often used by a large number of people on a daily basis. People can experience the differences between green buildings and regular ones during their visit, especially in terms of higher levels of thermal comfort, larger

green spaces, greater vitality, lower absenteeism, and utilizing natural lighting. This offers an opportunity to introduce and advertise green buildings to the public. This may encourage more developers to choose a greener lifestyle. By encouraging the use of prefabricated building materials, building component production off-site will result in reduced material waste, improved quality, and faster construction (Yee, 2001). With the depletion of raw materials and worries about managing the massive amounts of construction waste, reducing waste generation alone is a significant incentive (Tam et al., 2007). Sustainable development involves a number of changes to the way we typically think and make decisions, with an eye toward the effects of those decisions. A few steps should be taken in order to maximize public collaboration, given the challenges associated with changing habits. One of the most important things to do in order to maximize collaboration when trying to achieve sustainable development is to consistently explain to the public why going green is so important. This can be achieved by making clear how serious the repercussions will be if sustainable policies are not put into place. The effects of human activity and the built environment on ecosystems should also be made more widely known. It is still not sufficiently understood how dangerous global warming is and how it will affect future generations in a catastrophic way. The following are some additional important pieces of knowledge regarding sustainability that communities should develop: Building energy and water conservation measures; rebuilding, repurposing, and renovating structures rather than demolishing them and recycling waste; and prioritizing the use of ecologically friendly building materials (Tam et al., 2007).

In order to dispel the myth that building green is expensive, it is also important to make the public aware of the costs involved in doing so. According to research, green project management techniques can significantly increase the value of a sustainable construction project and complete it within reasonable budgetary constraints (Robichaud et al., 1998). The public needs to be effectively informed about the benefits that come with owning and occupying green buildings, as well as the fact that many of them are cost-effective or have marginally higher initial costs. The success of sustainability in promoting training and learning about green practices depends on how universities react to the concepts created by the general interest in sustainable development (Augenbroe et al., 1998). Green practice implementation requires experience. Encouraging the acquisition of this knowledge is yet another essential component of going green. People will learn how to do their share rather than just following instructions when more people become knowledgeable about sustainable

construction, facilitating easier and more seamless collaboration and communication amongst them. There are various levels of this training and education available. Small workshops for a construction team, mandatory non-academic courses, and university courses for construction education are all examples. In an effort to sustain continuous learning, it is crucial to keep this education consistent, the authors stated.

According to Outram (2024), the construction industry is faced with dynamic challenges that require innovation to ensure the industry's long-term viability. The COVID-19 pandemic brought climate change issues—such as the need to develop a cleaner, greener construction industry—to the forefront of public attention, as it does in many other industries. International construction firms encounter dynamic obstacles, such as heightened scrutiny concerning their environmental, social, and governance (ESG) posture. Businesses are looking for innovative products and processes to "build better" and create a more sustainable industry. As a result, they are making a variety of strategic changes to their business models. As the construction industry actively looks for ways to improve procedures, goods, and established working models, innovation can play a significant role in sustainability. Creating and implementing procedures that increase the use of sustainable materials is essential to lowering the industry's carbon footprint. Many construction companies have raised their standards and requirements in response to the growing green movement. A growing number of construction companies have increased their internal standards in response to the growing emphasis on sustainability. Departments responsible for corporate social responsibility collaborate across project domains to integrate new procedures and tactics into the company. The goal is to infuse creativity into the design process. The environment is directly and favourably affected by this. Many areas have set 2050 as the deadline for the construction sector to become carbon neutral, but inspirational businesses want to hit this mark earlier. Businesses that don't source sustainable materials or follow environmental regulations risk negative effects on their revenue and reputation. According to the Paris Agreement, building-related carbon emissions globally are expected to decrease by 80–90% by 2050. The building sector is rising to the occasion.

Outram (2024) stated that the building material industry is producing a plethora of innovative solutions that, when combined, will hopefully lessen the industry's carbon footprint. These range from incremental innovations of traditional methods to radically innovative materials

with entirely new functions. Artificial intelligence (AI), robotics, drones, 3D printing, modularization, and robotics are all promoting efficiency and reducing project duration. One such technique is testing ideas and design concepts before the start of construction. Using artificial intelligence (AI) and machine learning algorithms to produce product or building designs in a matter of minutes enables designers and architects to maximize their concepts and produce structures that were previously unthinkable. Sustainable development is a major area of focus for built environment innovation. This includes more eco-friendly, cleaner construction techniques that also contribute to waste reduction. In addition to increasing the use of electric plants and biodiversity in project design, the construction industry is looking to use new materials and develop better methods of storing renewable energy. There are lots of chances to have a good influence. A large portion of the technology needed to lower the carbon footprint of construction is already in place; the sector just needs to scale it quickly. Understanding project risk and how to collaboratively allocate it appropriately should receive special attention to support the creation and implementation of systems, products, and processes that revolutionize the market and guarantee its sustainability. Everyone working in the construction industry is focused on promoting sustainability and cutting emissions. Innovation is going to be a key component in both cost reduction and increased sustainability (Dosumu & Aigbavboa, 2021).

Hwang and Tan (2012) believed that project management teams could improve and promote sustainable building processes to increase the adoption of these methods. This is because they are recognized as important players in the construction industry who make sure that project goals are achieved and completed successfully. Moreover, throughout the construction process, project management teams should embrace fundamental sustainability objectives (Roe, 2012; Hills et al., 2008).

According to Kubba (2010), the main objectives of sustainability for the construction sector are to lower energy use, protect the environment, improve occupant health, and increase productivity. Numerous investigations have been carried out to enhance comprehension and investigate the advantages of sustainable building practices for the developing country construction sector. For instance, recognizing the fundamental forces behind environmental sustainability in construction (Opoku et al., 2019a); comprehending green certification and how the Green Construction Industry (GCI) applies it (Agyekum et al., 2019); and implementing green building technologies in structures (Darko et al., 2018).

According to Ayarkwa et al. (2022), research has also been done to increase the construction industry's knowledge base on sustainable practices. Examples of these studies include examining the obstacles to environmental sustainability (Opoku et al., 2019b); putting in place a green certification process for buildings (Ampratwum et al., 2019); and figuring out how organizations could function in sustainable-led construction projects (Mensah et al., 2014). Notwithstanding the results of current research, there is empirical support for the idea that project management teams' preparedness to improve sustainable building practices can facilitate the concept's acceptance and application in the building sector of developing nations.

According to Wu and Low (2010), there are a number of difficulties that come with construction; the longer it takes to build and the more activities required, the more likely it is that the environment will be negatively impacted. Nonetheless, a number of tactics could be used to deal with these difficulties. Adopting green building techniques and sustainable construction practices, according to Hwang and Tan (2010), could lessen these difficulties. Nevertheless, implementing sustainable building practices presents a number of difficulties for project management teams. For instance, safety management will raise the cost of sustainability due to its financial expenditure implications (Li et al., 2019a, 2019b). A number of techniques that could aid people in understanding sustainable building and construction practices were delineated by Arditi (2009). The key to reducing environmental impact is to implement an environmental improvement system. putting in place efficient waste management systems and making sure that all of the workplaces are energy-efficient. Using the appropriate building techniques can help save money by preventing needless expenses. Adopting safe and healthy management systems is important for health and safety. Regular conferences for training novice construction techniques and goals for all website online workforces are necessary in the area of physical resources, the study maintained.

According to Ahadzie (2007), variables should be regarded as keen and having a significant impact on the measured dimension if their index is greater than 0.700. It is reasonable to conclude that the survey experts' top priority was informing owners about the long-term advantages of green building. It was determined that educating stakeholders about the long-

term advantages of green buildings could improve the implementation of the concept, despite the high initial cost, in order to lessen the difficulties that project management teams faced when implementing sustainable building processes in the GCI (Opoku et al., 2019).

Simpeh and Smallwood (2015) stated that a lack of knowledge about the complete range of advantages that sustainable practices can provide, particularly in developing nations, makes people less willing to invest in them. Experts gave this variable a high ranking because it is possible that owners' awareness of the sustainable building process will have a knock-on effect, influencing the designs that project management teams decide upon early in the project. According to Wu et al. (2019), project management teams would have an easier time persuading stakeholders to adopt green and sustainable building practices if they provided training and education.

Due to the intricacies and financial consequences of the sustainable building process, professionals with training in green building must be consulted from the outset of the construction project (Wu et al., 2019). According to Nduka and Sotumbo (2014), purchasing sustainable buildings offers chances for other industry stakeholders as well as advantages to purchasers and consumers. Project management teams would face fewer difficulties when collaborating with a group of experts who comprehend sustainable building procedures and have experience with green building, according to the survey's experts. With their exceptional skills, this group of professionals could significantly reduce waste and rework and provide excellent advice on material selection, energy efficiency, and operational efficiency during construction (Hwang et al., 2016).

It is imperative to implement key sustainable principles from the project's feasibility stage onwards to ensure the sustainability of construction projects (Darko, 2019). This is due to the fact that modifications to the construction drawings, the selection of materials, or even the procedures and ideas to be used for the building at this point have little to no financial ramifications (Wu et al., 2019). Setting sustainability goals could also help project management teams make better decisions and take more initiative when presenting and completing projects within predetermined budgets (Zhang et al., 2011). The goal is to create

settlements that uphold human dignity and promote economic equity, all the while restoring and maintaining harmony between the natural and built environments, according to the United Nations Environment Programme. Put more simply, the goals of sustainable construction are to reduce the negative effects on the environment, make efficient use of resources, provide liveable conditions for people, and improve occupant quality of life.

According to Planradar (2023), different approaches and strategies can be combined to achieve sustainability in the construction industry. These consist of waste minimization techniques, the use of renewable materials, and energy-efficient design principles. By putting these strategies into practice, the construction sector contributes significantly to making cities more resilient and sustainable by reducing the environmental impact of urban growth. While there is no denying the benefits of sustainable construction, there are many obstacles in the way of realizing them. The higher initial cost of sustainable construction in comparison to traditional methods is one of the biggest obstacles. The use of energy-efficient systems, green building materials and the requirement for professional certifications are the main causes of this. Although these components help create a building that is more sustainable and friendly to the environment, they can also raise the project's overall cost. But it's crucial to remember that over time, energy savings and rising building values can frequently offset these initial costs. Incorporating sustainable materials and energy-efficient systems allows developers to build buildings that are more resilient and economical over time, while also lowering their carbon footprint. Sustainable building is a wise investment because of its long-term advantages and favorable effects on the environment, even though the initial cost may seem high, the report said.

It is difficult for people used to traditional construction techniques to adopt a sustainable construction mindset because it requires a fundamental change in perspective. It includes adopting a more sustainable mindset in addition to having a thorough awareness of novel materials, state-of-the-art techniques, and building regulations. The industry's general lack of expertise and understanding of sustainable practices can make this transition especially difficult. But the conditions for a more ecologically conscious and greener future can be created in the construction industry if adopting these new ideas and keep improving knowledge. It is clear that building codes and regulations have not kept up with the rapid

advancements in sustainable construction practices, even with some recent progress. The existing codes, which are mostly based on conventional building techniques, can present serious difficulties and needless barriers for green builders who are trying to integrate sustainable solutions. Furthermore, getting approval for creative sustainable designs can often be a lengthy and complex process that involves many parties and factors. The increasing demand for eco-friendly construction has made it imperative for regulatory frameworks to change and adapt in order to facilitate the smooth incorporation of sustainable practices into the built environment. Although consumers are becoming more conscious of the value of sustainability, it is regrettable that there is still little demand for green buildings. People must be made aware of the many advantages of sustainable building for their own health and well being as well as for the environment (Weerainghe & Ramachandra, 2018).

Green buildings can enhance indoor air quality and drastically lower their carbon footprint by implementing eco-friendly techniques like energy efficiency and the use of renewable materials. Still, developers face an uphill battle in trying to defend the higher upfront costs of green building due to the lack of demand. Continuing to raise awareness and emphasize the long-term benefits of sustainable construction is crucial to creating a stronger market for green buildings. There are many reasons to be optimistic about the future of sustainable construction, even with all of the challenges that lie ahead. Energy-efficient systems and environmentally friendly building materials are becoming more and more affordable. Furthermore, training and education initiatives are vital in closing the knowledge gap in the sector and providing professionals with the know-how to adopt sustainable practices. Furthermore, as a result of policy changes, developers are increasingly adopting sustainable construction practices, opening the door to a more ecologically friendly way of building. There is a rising need for sustainable building solutions as the effects of climate change become more obvious. Consumers with knowledge are actively looking for environmentally friendly options for every part of their lives, including the buildings they live in (Yurdakul & Kazan, 2020). Although there are still challenges in the path of sustainable construction, the sector is making great strides in overcoming them. With continued innovation, education, and policy changes, sustainable building looks to have a bright future. It is indisputable that implementing sustainable practices has positive environmental effects for both the planet and the welfare of future generations. As a result, the work put into sustainable building is genuinely valuable and helps ensure a better future.

2.7. Championing sustainability at work

The greatest course of action is to discuss sustainable practices with the leadership team and fellow employees. Preaching to them is not essential; but, educating people about their options, emphasizing the advantages of sustainability, and modelling sustainability will have a beneficial effect (Blayse & Manley 2004).

Malkin (2021) indicates that champions for sustainability can help the organization's sustainability credentials grow. It can be a terrific way to create high-level change, encourage departmental collaboration, and grow the business network. A sustainability champion can be anyone working for the company. It is not necessary for participants to possess specific knowledge about sustainability; what matters most is their motivation. To make sure that sustainability becomes ingrained in the business practices and that input is received from all areas of the organisation, encourage participation from a diverse range of staff members. A sustainability champion can be anyone working for the company. It is not necessary for participants to possess specific knowledge about sustainability; what matters most is their motivation. Obtain the backing of upper management. Assign distinct responsibilities Emphasise the business benefits of sustainability champions programme to senior management in order to win their support. Agree on the scope of work and resources available to support the group's constructive actions, as well as the availability of resources like staff time, funds, and duties. Establishing a system for disseminating the work to the senior leadership team within the organisation can facilitate prioritisation, keep things moving forward, and accelerate development. Think about including a typical green or sustainability item on the board agenda. The programme can greatly benefit from having a senior management representative serve as a champion for sustainability. The exact role that sustainability champions play will depend on the specifics of your programme. Make sure that duties are appropriate, doable, quantifiable, and scheduled, and that line managers have approved them as needed. Make sure that this covers the anticipated amount of time, as well as attendance at events and meetings. A rotating system of sustainability champions could be a good idea to allow everyone to participate in the programme. These procedures are flexible, and you may find it helpful to make changes to them. Since you are the one who knows your co-workers the best, you will also have important knowledge about how different people react. It's critical to use your institutional knowledge and gut feeling. Make a plan for information sharing, preferably through channels that are already extensively utilised in your

company. Think about the best time and location for holding frequent meetings to share updates, get input, and keep the momentum going. Consider the best way and location for other members of your organisation to learn about your sustainability programme. Update coworkers on your progress and recognise accomplishments by sending out a newsletter every month or setting up frequent update sessions. Events, meetings, initiatives, and actions should all be closely watched in order to assess results, spot new opportunities, and highlight any areas of concern or resistance. Clear facts and figures should be used when reporting initiative results to staff and senior managers. Don't forget to acknowledge contributions and give success awards, the study stated.

Charlotte Cameron (2020) discovered that achieving the organization's sustainability goals requires finding sustainability champions who can ignite the team's passion. Realising the team's passion is essential to accomplishing the sustainability objectives of your company. Establishing a green team, or a group of champions for sustainability, will help meet sustainability goals and foster a culture of purpose in the workplace. One of the most important and empowering things to do is to advance the sustainability journey is to put together a progressive and successful green team or group of sustainability champions. Anyone working for the company is welcome to join this group, regardless of their background or level of expertise in sustainability-related subjects. Sustainability champion's team can be an excellent means of growing business network, encouraging cross-departmental cooperation, and bringing about high-level change if they are driven and passionate about the cause. Putting together a specialised team of sustainability champions gives workers a chance to grow professionally and engage with different areas of the company. An informed and involved workforce feels appreciated, which boosts morale and enhances the working environment.

.

2.7.1. Any need to be rich to be sustainable

Many sustainable stores, whether they sell clothing, food, or skincare, have been seen to be quite pricey. This gives the impression that sustainability is rather expensive, yet this need not be the case (Deniyi, Mohamed, & Rasak 2020). Much sustainable behaviour, like using less energy, forgoing wasteful purchases, and preventing food waste, were really born out of

a desire to save money. In spite of having little money or other goods, indigenous people are among the most sustainable of all (Bamigboye et al 2019)

Thecircularconsumer (2021) asserts that adopting a sustainable lifestyle does come with additional expenses. Actually, sustainable products ought to cost more money. Paying workers a fair wage, sourcing materials sustainably, and producing goods that adhere to certification standards come at a higher cost. The question then arises: Is living sustainably more costly than "mainstream or traditional" living? Man can live a sustainable, budget-friendly lifestyle by disconnecting from consumerism, making fewer purchases, reusing or repurposing goods, and selling things that are no longer needed. The true purpose of sustainability is to preserve nature and lessen our impact on the environment, which can be achieved in this way as well. The issue is that this message is not the same as the popular one, which says you can buy the way to sustainable living by simply buying the sustainable version while maintaining the current consumption patterns. It is true that living a sustainable lifestyle is costly if these guidelines are followed. The goal of sustainable living is to lessen the impact on the environment through waste reduction, local economic support, smarter shopping, and reduced consumption. Therefore, the author believed that the most "expensive" aspect of sustainable living is making a mental shift and forging a new route away from mainstream consumerism. Although transitioning is difficult, there are steps to be taken to make it easier. To help make tiny adjustments that fit the lifestyle, keep in mind that the most sustainable product is the one that is already owned—even if it's plastic. Sustainable living isn't perfect, so ask questions of media sources that support it. Due to all of the aforementioned trends, the cost of living can now perceive a more sustainable lifestyle to be higher than it actually is. In actuality, leading a more sustainable life is not about owning ostentatious goods or consistently achieving perfection. Reducing our carbon footprint as much as possible is the primary objective. Although using sustainable products can help reduce our carbon footprint, more impactful habits can be made that cost much less or even nothing at all. The report offered suggestions for being more economical and sustainable, such as stated below:

1. **Thrifting versus sustainable version:** If purchasing eco-friendly apparel is out of the price range, there are still ways to update your look and protect the environment without breaking the bank! The obvious thing to do in this situation is thrift! shop on Carousell, in charity stores, or in the neighbourhood thrift stores can be chosen! In addition, trading old

clothes for new ones with friends, family, or via clothing exchange websites like Refash or Swapaholic can also be considered.

2. Purchasing new jars as opposed to reusing existing ones: when thinking about buying the pantry items in bulk, existing containers could be used instead of purchasing new jars! Although it may seem obvious, people's desire for the ideal pantry complete with matching jar sets and other accessories has regrettably been fuelled by advertising and fashionable sustainable products. So let's avoid that pitfall and just get by with what is already obtained. The pantry may not have the most attractive appearance, but mismatched jars and containers still have the same function.

3. Pricey salad bowls versus street food: Maintaining a sustainable lifestyle also entails limiting the carbon footprint by eating certain foods and avoiding others. And again, assumption could be made that salad bowls and a vegan diet are the only options available because zero-waste influencers are always pushing for those things. Nonetheless, selection could be made from far less expensive meatless options in hawker centres. When going vegetarian, caifan, or economical rice, becomes an even more cost-effective meal option. Therefore, the answer is no, sustainability isn't just for the wealthy. Everyone can contribute to saving the planet, even if the finances are limited. Most importantly, there is a need to start somewhere and keep going, even if the path has ups and downs, in order to contribute to the health of the planet. Perfect steps are not necessary. Therefore, there will be no excuse anymore not to adopt a more sustainable lifestyle (Lee 2022).

Pietential (2022) indicates that what difference would it make if the richest person on the planet donated all of their wealth to the nation with the lowest standard of living, distributing it equally among the underprivileged so they could live on for two months?
it is always common to assign blame to others and seeking out scapegoats to hold accountable for our own transgressions. Thus, man prefers to think that the world's wealthiest individuals are the only ones who can find a solution to the problem of poverty. However, what part do man play in that? Is money really the secret to solving all of problems? But what happens if the impoverished nation runs out of cash? Any need to look to the next richest person for hope? The symbiotic system starts to break down if consumption trends excessively. Furthermore, the harmonious cycle cannot be resumed until the rate of

production equals the rate of consumption. When faced with an issue, there are two options: either patches it up to make it look less ugly or fix it entirely to solve the problem. The first solution only provides a momentary sense of relief; it is not permanent. However, the second approach solves the issue permanently. Additionally, giving money to the impoverished is a band-aid solution to the underlying social problems of, among other things, a lack of resources, inadequate healthcare, and a lack of education. A society requires a self-sustaining cycle of wealth and resources in order to attain financial stability. Opportunities and resources must be provided for people to use in order to grow. They require a system that involves them, counts on their involvement and contributions, and pays them back. A community is deemed sustainable if it has access to a variety of resources, is well-educated, has adequate housing and health care, and operates a steady system of creating and distributing wealth. Instead of waiting for the richest person on Earth, this self-sustaining ecosystem helps its people find equilibrium again, the author indicated.

2.8. How design thinking helps with sustainable development

Consider using design thinking as a crucial strategy when considering sustainable development. The use of design thinking by technology corporations to address issues and come up with novel solutions to global problems could be gained from designing for a sustainable future (Frigione & Aguiar 2020).

Filiberto Amati 2022 indicated that one novel and imaginative way to tackle some of the most difficult issues of the modern world is through design thinking. Finding a solution that has a positive impact on the future is the goal of design thinking, which tries to generate innovative and user-relevant ideas. In today's world, projects or problems that have the potential to affect the future require the application of design or solution-focused thinking. As a result, many managers, leaders, and teams throughout the world are implementing the design thinking approach in a variety of projects, organisations, and businesses. Many people may be curious about the distinctions between analytical and critical thinking and design thinking. Coming up with a long-term problem's solution is part of the design thinking process. A common feature of analytical thinking is identifying and resolving the issue up

front. Finding a long-term solution to a problem without completely limiting or knowing exactly what the future will look like is the overall goal of design thinking.

Human-centred design is among the best instances of design thinking in action. Human needs and wants are specifically addressed by human-centred design. Effective design thinking methodologies seek to address and oversee unfulfilled human needs in the long run, as opposed to emphasising temporary fixes. One way to make something more sustainable is to make it reusable. Moreover, the increasing popularity and widespread adoption of human-centred design in organisations underscores the critical importance of honing this approach and skill, especially in relation to sustainable issues and human needs (UNDP, 2017),

Concerning sustainable and non-sustainable issues, there is some misunderstanding, though. For instance, there is currently a strong global voice in favour of human sustainability. The most prevalent instances are the ways in which people work with society and the environment to get past difficulties and barriers. Recyclable materials like cardboard and plastic can be used by individuals and companies to improve the environment. These plastic balers, that are available for purchase and rental, may be of interest to businesses wishing to enhance their recycling tactics. They can help make sure that the company and the staff are acting in a way that is environmentally responsible (Dr. Jaber, 2020). By using green energy plans, consumers can make decisions that are more environmentally friendly. Many are moving to programmes that permit specific services, like prepaid lights and other components with constant energy consumption, to have set energy use. This implies that they can reduce expenses while also becoming more ecologically friendly. Many people think that conserving and safeguarding the environment is related to sustainable issues. "Sustainable" problems are primarily concerned with maintaining human existence, which are a fundamental human need and a good illustration of human-centred design. Additionally, by applying human-centred design, or design thinking. Today’s professionals and organisations will be able to anticipate and effectively address the needs of people and businesses as well as those of technology for the next century.

Maya Jaber (2020) discovered that in order to practise sustainability, one must create champions for the vision they are pursuing, understand the struggles and labour of others, and unite the organisational community. Understanding the end user is essential to any design process, whether it is creating a product or a space. The utility of the design must be

determined, expressed, and put to the test. Getting input is the next step in making sure the work will be worthwhile. Leaders in sustainability can use Design Thinking techniques to improve workflows, promote adoption from all angles, and help develop the innovations required for radical change. This method can help with multi-level business enhancement strategies and is used as a tool for change management. By incorporating those practices into every aspect of our work as a company, we can create a platform for continuous learning and agility. Organisations must adapt to the ever-changing global landscape of today owing to social justice, pandemic evolution, and climate change. Companies are realising that they need to start enterprises with people who can adjust to changing market conditions and navigate them. When these problems recur, having a workforce that makes use of these tools will enable organisations to develop and flourish.

World Economic Forum (2023) states that in thinking creatively; one can be innovative and take inspiration from different social models without endorsing any one political system or ideology. The idea is that one should once again embrace a multipolar world, broaden the range of creative resources available to decision makers, and diversify technology. To achieve this, we must take another look at design thinking, one of the most important business concepts of the last several years. Design thinking has been associated with innovative problem solving in a business setting for over ten years. But the idea has become more and more limited to a small set of steps and techniques that, in theory, anybody can use to develop prototypes of possible solutions, create new ideas with others, and understand users. In ways that many professional designers could not have predicted, design thinking has helped to democratise the field of design, something that many find unsettling. Positively, this has helped people all over the world gain an understanding of fundamental design principles. On the down side, it runs the risk of presenting a restrictive and simplified picture of what design is and can be. A new era of design awaits us, replacing the one marked by design thinking. In order to address our future challenges, promote happy, healthy, sustainable, and prosperous lives, and drive significant societal change, design—in its broadest sense, which includes design thinking, still has a long way to go.

Design thinking is a way of thinking and a process that includes identifying problems with the users, coming up with ideas for potential solutions, testing and prototyping them, then putting them into practice and making adjustments as needed. By using design thinking, one

can better comprehend the needs, motivations, and behaviours of your users and develop solutions that are viable, desirable, and feasible. In addition, design thinking pushes one to accept ambiguity, question presumptions, and grow from mistakes. Because it enables one to take into account the environmental effects of the solutions at every stage of their life cycle—from production to consumption to disposal—design thinking is pertinent to environmental sustainability. Investigating how one solutions might add value beyond just the financial to the social and environmental spheres is another benefit of design thinking. One can develop solutions that are competitive, economical, user-friendly, and environmentally friendly by utilising design thinking (World economic forum, 2023)

The steps below can help implement design thinking to build an eco-friendly company: ● Set first the challenges and goals for sustainability. ● Think about how the organisation and its users are impacted by environmental issues, and how one can assess and enhance the environmental performance. ● Contemplate the obstacles and opportunities associated with putting sustainable solutions into practice. ● furthermore, develop empathy for the stakeholders and users. Know their requirements, inclinations, and areas of discomfort. ● In terms of environmental issues, think about how they view and engage with the solutions.
● Develop and test sustainable solution prototypes. ● Create concepts that minimise the negative effects on the environment by utilising materials, technologies, and processes that meet both user needs and sustainability goals. ● Apply and refine sustainable solutions. Lastly, launch and scale them while keeping an eye on the results and effects they have on the environment. On getting feedback, keep improving on solutions (Amati, 2022). There are numerous sectors and contexts where design thinking is being applied to environmental sustainability. The apparel brand Patagonia employs design thinking to make products that are long-lasting, recyclable, reusable, and composed of recycled or organic materials. Additionally, they involve their clientele in environmental activism and education. Design thinking is used by furniture retailers to produce goods that are more economical, useful, and environmentally friendly while also being sustainable. The search engine Ecosia uses design thinking to develop a service that is transparent, easy to use, and environmentally friendly. In order to offset their carbon emissions, they use green servers and donate 80% of their profits to global tree planting initiatives. In big businesses, Design Thinking speeds up the associated change-management procedures and makes it easier to implement sustainability initiatives. It offers assistance so that everyone involved can contribute to the goals of the organisation. It

is also an effective strategy for carrying out the Sustainable Development Goals (Amati, 2022).

2.8.1. How stakeholders compare sustainability and ESG (environment, social, and governance

ESG stands for environment, social, and governance, thus it is obvious that the idea will intersect with sustainability to some extent (Alves et al 2018). The primary distinction between the two is that although sustainability is a more general and ambiguous concept, ESG is precise and measurable. This means that businesses can utilize ESG criteria to inform practical decisions and actions that will help them become greener, more moral, and better run (Brian, 2015).

According to Brown (2023), the term "environmental, social, and governance" (ESG) refers to a group of non-financial factors that are taken into account when developing corporate strategies and making investment decisions. While not a brand-new idea per se, ESG is starting to gain traction and become a key component of financially responsible businesses. ESG focuses on socially responsible investing as a defining theme for business operations that support access and representation for people of colour within companies, as well as investing that can have a significant impact on long-term investment returns. The various overarching factors are the focus of the ESG components. Climate change, the depletion of natural resources, pollution of the air and water, and environmental opportunities are all considered environmental factors that are oriented towards the preservation of the natural world. Social factors take relationships and people into account. They are primarily concerned with human capital, product liability, and opposition from stakeholders in areas like community relations and contentious sourcing, as well as social opportunities. Corporate governance, corporate behaviour, and governance opportunities are all included in governance, which sets guidelines for running a business. A company's investment policies that promote sustainability are important to stakeholders and stockholders alike, as ESG is still a hot topic. Customers and staff expect businesses to support causes that are important to them more, the study revealed.

Brindisi, Martin, and Kay (2020) were of the opinion that companies may consider incorporating some stakeholder metrics into their compensation plans to highlight these priorities as stakeholder priorities continue to change and addressing them becomes a strategic imperative. Companies and Compensation Committees need to take into account the specific industry environment, business model, and cultural context of each organization when they discuss incentive metrics that are focused on stakeholders and ESG. Although corporations' primary goal will always be to maximize profits, the report's statement supports giving all stakeholders' need top priority in order to promote the long-term, sustainable success of the company. Implementing incentive metrics that are in line with this larger context can be a useful tool for some businesses to spur these efforts over the long and short terms. Having said that, good implementation will depend on careful planning, timing, and communication.

The Environmental, Social, and Governance (ESG) framework, according to Blair (2023), is utilized to evaluate how well an organization performs on a range of ethical and sustainable business issues. ESG investing is the practice of some investors in the capital markets using ESG criteria to assess companies and assist in determining their investment plans. An ESG program's purpose is to guarantee accountability and the implementation of systems and procedures to manage a company's impact. ESG programs support larger business sustainability initiatives, which put companies in a position for long-term success through ethical corporate governance and sound business practices (Blair, 2023). Though they are not widely understood, Blair (2023) report on Sustainability, and Environmental, Social, and Governance (ESG) are the new terms that are being used frequently in business and environmental discussions. Companies have been found wanting in the introduction of these concepts, which are now being demanded by society at large, and even their application is not well understood. Sustainability is a broad term that came from the study of ecology and was later extended to encompass social and economic dimensions. It speaks of the capacity to provide for the needs of the current generation without sacrificing the capacity of future generations to provide for them. The economic, social, and environmental pillars of sustainable development serve as the foundation for this concept. In order to ensure society's long-term prosperity and well-being, sustainability aims to strike a balance between these three dimensions. A framework called ESG (Environmental, Social, and Governance) assesses the environmental, social, and governance performance of businesses, investments, or projects. It also examines how the world affects investments and companies. Investors and

other stakeholders can evaluate the possible risks and opportunities linked to a specific entity by using this set of criteria.

To encourage morally and responsibly, ESG considerations are incorporated into decision-making procedures. "With regard to ESG factors in particular, Environmental factors encompass elements like resource conservation, pollution control, waste management, and climate change mitigation. Human rights, labor practices, diversity, and community involvement are all considered social factors. The ethical behaviour of a company, shareholder rights, board composition, and management calibre are all considered governance factors. Whereas ESG is a particular set of standards used to assess how well businesses, investments, or projects perform in relation to environmental, social, and governance issues, sustainability is a more general term that encompasses the overall balance between economic, social, and environmental factors to ensure long-term prosperity (Kay, Brindisi and Martin, 2020).

It's critical to comprehend the distinctions between ESG and sustainability for a number of reasons. Their objectives and areas of focus differ: Aiming to strike a balance between social, economic, and environmental factors for the long-term welfare of both the present and the future generations, sustainability takes a more comprehensive approach. In contrast, ESG is a more focused framework that evaluates how well investments, projects, and companies perform in terms of environmental, social, and governance aspects. Acknowledging the differences between these two ideas enables stakeholders to more successfully address their particular goals. By distinguishing between sustainability and ESG, companies, investors, and legislators can make more informed choices. Sustainability offers a comprehensive strategy for creating long-term value, whereas ESG concentrates on locating and comprehending this differentiation empowers interested parties to take more deliberate and focused decisions. There are differences in performance measurement and reporting for both concepts. Sustainability and ESG metrics are being used by businesses and investors more and more to assess and communicate their performance. Different voluntary standards and legal frameworks apply to sustainability and ESG. Comprehending the distinctions between these notions can aid companies and financiers in guaranteeing adherence to pertinent laws and implementing suitable optimal procedures. Finally, the interests of various stakeholder groups

in sustainability and ESG matters may differ. Businesses can interact with stakeholders more effectively, respond to their concerns, and generate shared value if they know how these two ideas differ from one another (Brown, 2023)

Delivering value is predicated on the transition from shareholders—which emphasizes value transfer—to stakeholders, which emphasizes value creation. If the business is successful in this endeavour, numerous opportunities for enhanced value propositions may arise. Because they assist businesses in addressing the opportunities and risks related to environmental, social, and governance issues, ESG and sustainability best practices both add value and have the potential to enhance long-term value creation for organizations. Businesses are better equipped to anticipate, detect, and control risks related to environmental, social, and governance issues—like labour relations, climate change, and regulatory compliance—when they combine sustainability best practices with ESG. This contributes to the preservation of the business's assets, value, and reputation. By reducing waste, conserving energy, and managing resources more effectively, sustainable business practices frequently result in increased operational efficiency. This helps a company become more competitive and saves money for both the business and the employees. Businesses that adopt ESG best practices and sustainability are more likely to create cutting-edge goods and services that meet changing consumer needs and societal issues. This may create new markets and sources of income. Strong ESG performance and a dedication to sustainability can help businesses draw capital from an expanding group of ethical and impact investors, which could cut their capital costs.

Businesses that prioritize sustainability and ESG are more likely to draw and keep top talent, as well as have higher employee engagement. Improved overall performance is a result of a skilled and motivated workforce. Concerns over the social and environmental effects of the goods and services they buy are growing among consumers. Businesses can improve their market position by fostering consumer loyalty and brand reputation through the implementation of sustainable and ethical practices. Companies can stay ahead of regulatory changes, ensure compliance, and prevent potential fines, penalties, or reputational harm by adhering to ESG and sustainability best practices. Businesses with sound governance practices outperform those without. Businesses that embrace ESG and sustainability best practices can generate long-term value for their stakeholders and shareholders by thinking

through the long-term effects of their choices and actions. This improves overall financial performance and resilience. Businesses with a social license to operate are more likely to continue to enjoy the confidence and support of the communities in which they operate when they adhere to ESG and sustainability best practices. A company's positive effects on society and the environment are enhanced by ESG and sustainability practices, which address global issues like resource scarcity, inequality, and climate change. To sum up, effective decision-making, risk management, performance measurement, regulatory compliance, and stakeholder engagement all depend on an understanding of the distinctions between sustainability and ESG. Understanding each concept's distinct objectives and focal points can assist companies, investors, and legislators in fostering ethical and responsible behaviour while generating long-term value (Brown, 2023); Kay, Brindisi and Martin, (2020).

Environmental, social, and governance, or ESG, investing is defined as a set of criteria for a company's conduct that socially conscious investors use to evaluate possible investments, according to Courage (2023). Environmental criteria take into account a company's methods of protecting the environment, such as its corporate policies regarding climate change. Social factors look at how it handles interactions with workers, vendors, clients, and the local communities in which it does business. The topics of governance include internal controls, shareholder rights, audits, executive compensation, and leadership in a company. Companies are encouraged to act responsibly by using environmental, social, and governance (ESG) investing to screen investments based on corporate policies. Portfolios can also benefit from ESG investing by avoiding holding businesses that use hazardous or unethical business practices. There have been accusations that businesses have been dishonest or deceptive in highlighting their ESG achievements due to the explosive rise of ESG investment funds in recent years, the author indicated.

As per the report published on https://www.apiday.com in 2023, a company cannot thrive in today's world if it does not engage with its surrounding community. Businesses need to do more for the community than just turn a profit. The company's growth and the longevity of its success are two advantages of this approach. "Environmental, Social, and Governance" is what ESG stands for. An organization's use of practices (policies, procedures, metrics, etc.) to reduce adverse effects or increase beneficial effects on the environment, society, and governance bodies is known as environmental, social, and governance (ESG) practices.

Investors are now more conscious of the significance of environmental, social, and governance (ESG) factors when making investments. Consequently, a great deal of companies has started incorporating ESG into their daily operations and business plans. ESG is a subset of sustainability. The Global Compact first used the term environmental, social, and governance factors (ESG) in 2004.

The concept of integrating all non-financial aspects into business, however, has existed for much longer. In recent years, ESG influence has increased dramatically. However, responsible business practices and sustainable investing are not new, and in fact, they have gained more traction in recent decades. It's critical to understand the differences between impact and CSR investing and ESG investing. Company's social responsibility (CSR) investments centre on a company's social responsibility; impact investments seek to produce a quantifiable and favourable social or environmental impact in addition to financial returns. ESG investments prioritize environmental, social, and governance considerations when making investment decisions. Environmental, social, and governance (ESG) issues are taken into consideration during the valuation process. In the private sector, a company's risks and practices are assessed using a set of criteria known as ESG. ESG frameworks are crucial to sustainable investing because they enable people or other businesses to assess a company's ultimate value for their objectives and decide if it is in line with their values. By proactively assessing possible problems, ESG risk management promotes long-term, sustainable growth. Early detection of possible risks gives organizations more time to adjust and create cost-cutting measures. Investors consider a company's overall risk and return, taking into account the quality of its ESG-related risk management (Brown, 2023; Kay, Brindisi and Martin, 2020).

Conclusion

The goal of this literature review is to get an awareness of the existing research and discussions regarding sustainability development in the construction sector, and to provide that knowledge in the form of a written report. Conducting this literature review contributes to the growth of knowledge in this sector. It enables the writer to learn about key concepts, research methods, and experimental approaches utilized in the field of sustainable development. It was also easy to see how researchers apply what they're learning to real-world challenges. Another significant advantage of reading literature reviews is that it

provides a better grasp of how research findings were presented and discussed in a specific discipline.

Chapter 3

Materials and Methods

3.1. Introduction

The general strategy, framework, and theoretical foundations that direct the research process were all included in the research methodology of this study. In scientific papers, this part is meant to help readers evaluate the validity of the research and, should they choose to, repeat it for confirmation. Generally speaking, this section contains a brief explanation of the tools, supplies, and methods utilized, along with information on how the study was carried out, the data were gathered, and any statistical or graphical analyses that were done. What was done and how it was done are described in the materials and methods. Enough information should be included for someone else to conduct a similar study. It should be organized logically, with related ideas kept together and, if feasible, written chronologically. This section is written in paragraph form. The foundation of the scientific method demands that experiments be repeatable: if the experiment is repeated under the same conditions, the same result should be obtained. Science is about discovering nature's laws. Enough information should be provided in the material and methods section to assess and, if necessary, duplicate the experiments described in the paper. This section carefully considers the possible readership. This makes it possible to provide just enough information, nothing more. After considering what the readership can reasonably be expected to know about the research environment, organisms, techniques, etc., details are provided appropriately—neither too little nor too much. This section is carefully examined during peer review. No matter how fantastic the results are, the manuscript will be rejected as unreliable if the reviewer has any reason to doubt the repeatability of the experiments or the appropriateness of the methods used.

3.2. Research Process

Saunders, Lewis, and Thornhill (2009) stated that to achieve the desired results research must be conducted by carefully collecting data, and analysing it to identify phenomena. It becomes clear that determining the research plan is essential when taking the research process into account. To help with this, Saunders Lewis and Thornhill (2009) present the research process

onion, which helps the researchers show the factors that influence the choice of data gathering techniques. The research process onion, according to researchers, is composed of five layers: time prospects, data gathering strategies, research methodology, research approach, and research philosophy (Saunders Lewis and Thornhill, 2009).

Using the research process onion model proposed by Saunders, Lewis, and Thornhill (2009), the approach for this study is developed. The methodological foundations of this dissertation are covered in detail in this part. The “Research Onion" below explains the methodology used for data gathering and analysis, as well as the philosophical underpinnings, ontology, and epistemology:

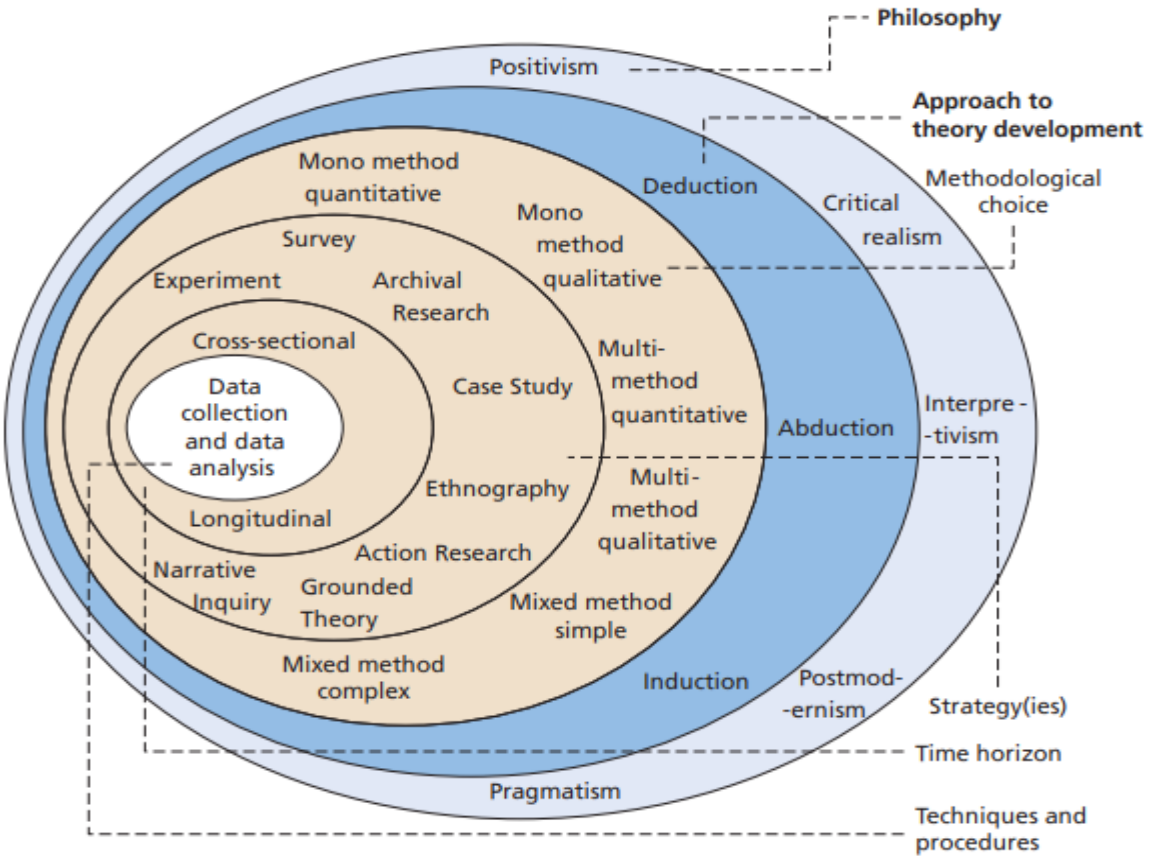


Fig. 2: Research Onion as a Framework

Source: Saunders, Lewis, & Thornhill (2016)

3.2.1. Research Philosophies

A philosophical research framework, which is characterized as "a system of beliefs and assumptions about the development of knowledge," serves as the foundation for all studies

(Saunders, 2015). Every step of a serious study involves decisions and assumptions made by the researcher that have an impact on the final product. These decisions and assumptions can range from selecting the research topic and designing the study to interpreting the results. They can also include assumptions about the body of knowledge that will be used, the researcher's perception of "reality" the questions that arise about the events or phenomena under study, and the appropriate methods to test those perceptions. These decisions and assumptions are all shaped by the researcher's values and beliefs (Saunders, 2015). Examining research methods according to their philosophy is the most fundamental method among the several ways to explain, theorize, and classify them (Clarke & Braun 2013). A philosophical approach to research methodology begins with certain basic principles about the world, such as the nature of learning and how it is substantiated, the mind, substance, reality, logic, and truth (Kallio, Pietilä, Johnson, & Kangasniemi 2016). Three categories—positivism, interpretivism, and realism—are used to categorize research philosophy.

There is a lengthy history of evolution, rebuttals, repetition, and re-evaluation in positivist thinking. The tenet of positivist thought is that there is an independent truth that exists independently of human behaviour and cannot be dismissed as a product of human imagination (Kallio, Pietilä, Johnson, & Kangasniemi 2016). According to positivism, science is the means of discovering the truth and improving our understanding of the world so that we may regulate and predict it. The universe is deterministic, functions according to the laws of cause and effect, and changes when we utilize science as a methodology. Thus, positivism views science as essentially mechanical or mechanistic. Testing and speculating on theories require methodical reasoning (Kallio, Pietilä, Johnson, & Kangasniemi 2016). We can determine whether a theory matches the facts based on the test findings; if not, the theory can be modified to more closely anticipate reality (Thorpe and Easterby-Smith (2015). The foundation of the scientific method is observation and measurement, according to positivists who embrace empiricism. The primary method used in scientific methods is experimentation, which involves direct manipulation and observation to identify and comprehend laws (Trochim, 2000). However, because the technique requires a planned research design, it has predefined restrictions for research. The approach's underlying presumptions state that researchers may influence the approach through their values or objectivity. Given that a single measurement would not be adequate to fully capture the complexity of the issue under

study, large samples should be used to draw conclusions that can be applied to the whole (Trochim, 2000).

The interpretivist/constructivist ideology might be summed up as anti-positivist, according to Hatch and Cunliffe (2006). In general, interpretivism is referred to as an inductive or theory-building model. Interpretivists hold that knowledge is ultimately tied to and influenced by the one who has acquired it and that there can be several realities (Denzin and Lincoln, 2003). Thus, to create conclusions for this research project, interpretivists endeavour to collaborate to comprehend and derive meaning from a variety of points of view (Hatch and Cunliffe, 2006).

According to Saunders, Lewis, and Thornhill (2009), the findings of these kinds of research are usually centred on comprehending the meanings and perspectives of specific individuals within their particular situations rather than being broadly applicable. Individuals' thoughts, feelings, and verbal and nonverbal communication styles should all be studied (Easterby-Smith, Thorpe, and Jackson, 2008). Because of the focus on language and the subjective nature of the data collection, this kind of study is seen as more qualitative than quantitative (Eriksson and Kovalainen, 2008). Because this paradigm is subjective and involves direct contact between researcher and subject, researchers are especially advised to carefully consider any bias that may unwittingly add into the study. The extremes of positivism and constructivism—construed as being too dependent on the individual and too dictated by the absolute control of natural laws—led to the development of the realist philosophy as a counterbalance. The realism knowledge of thought contends that although society shapes how people comprehend information, there are realities that are unrelated to or uncreated by human knowledge. According to Saunders, Lewis, and Thornhill's (2009) interpretation of this paradigm, a person's worldview is shaped by their social training.

Sayer (1994) and Blaikie (1993) claim that realists are essentially trying to comprehend and measure these mechanisms, but they also acknowledge that there are situations in which these mechanisms do not line up with empirical facts. Hatch and Cunliffe (2006), who define this layered type of reality in which observable occurrences are governed by underlying

mechanisms that are not easily evident to the outside observer, share the belief that events can occur without truly being experienced.

In conclusion, to investigate the topic at hand—the "Contemporary challenges of sustainability and regeneration in the Construction Industry"— the author of this study took a pragmatic approach. The reason for this is that the research entailed both measuring the efficacy of applying sustainable practices in the construction sector and investigating current trends in construction toward sustainability implementation. Incorporating both qualitative and quantitative methodologies to achieve the study's goal is made possible by the use of pragmatic philosophy. While positivist and interpretivism approaches are antagonistic to one another, pragmatism is an approach that contends that there are numerous approaches to understanding reality and conducting research; combining these approaches can lead to a more comprehensive understanding of the phenomenon under study. To find answers to the research questions, pragmatic researchers use operational decisions based on "what will work best" in their research designs. This approach allows pragmatic researchers to conduct research in novel and dynamic ways, ultimately leading to the resolution of research problems (Hatch and Cunliffe 2006).

3.2.2 Approach to Theory development

The methodological literature offers two research approaches. These methods are inductive and deductive. The top-down, deductive approach to research is characterized by the development of a thorough theory before the formulation of a summary hypothesis. After gathering enough information on the topic, the researcher analyses it to determine whether the hypothesis is true or false. It follows that this approach's application and subsequent evolution have a converging orientation (Hatch and Cunliffe 2006).

The antithesis of the deductive research methodology is the inductive approach. With this method, a narrow subset of the larger topic is thoroughly examined to conclude. Even if the portion under study initially appears unimportant, it ultimately turns out to be crucial to the overall research issue (Hatch, 2002). This method begins with reviewing the segment's observations and data, and evaluating it while considering the broader context (Denzin and Lincoln, 2003). Before concluding, the procedure essentially shifts from a particular area of

the larger research issue to a more generalized subject. In deductive research, a theory, hypothesis, or generalization is the starting point, and it is subsequently tested through observation and data collection. Using a top-down approach, the researcher formulates a general hypothesis before testing it with detailed observations. However**, a deductive method** would be used in this study **(Fig. 3 below).**

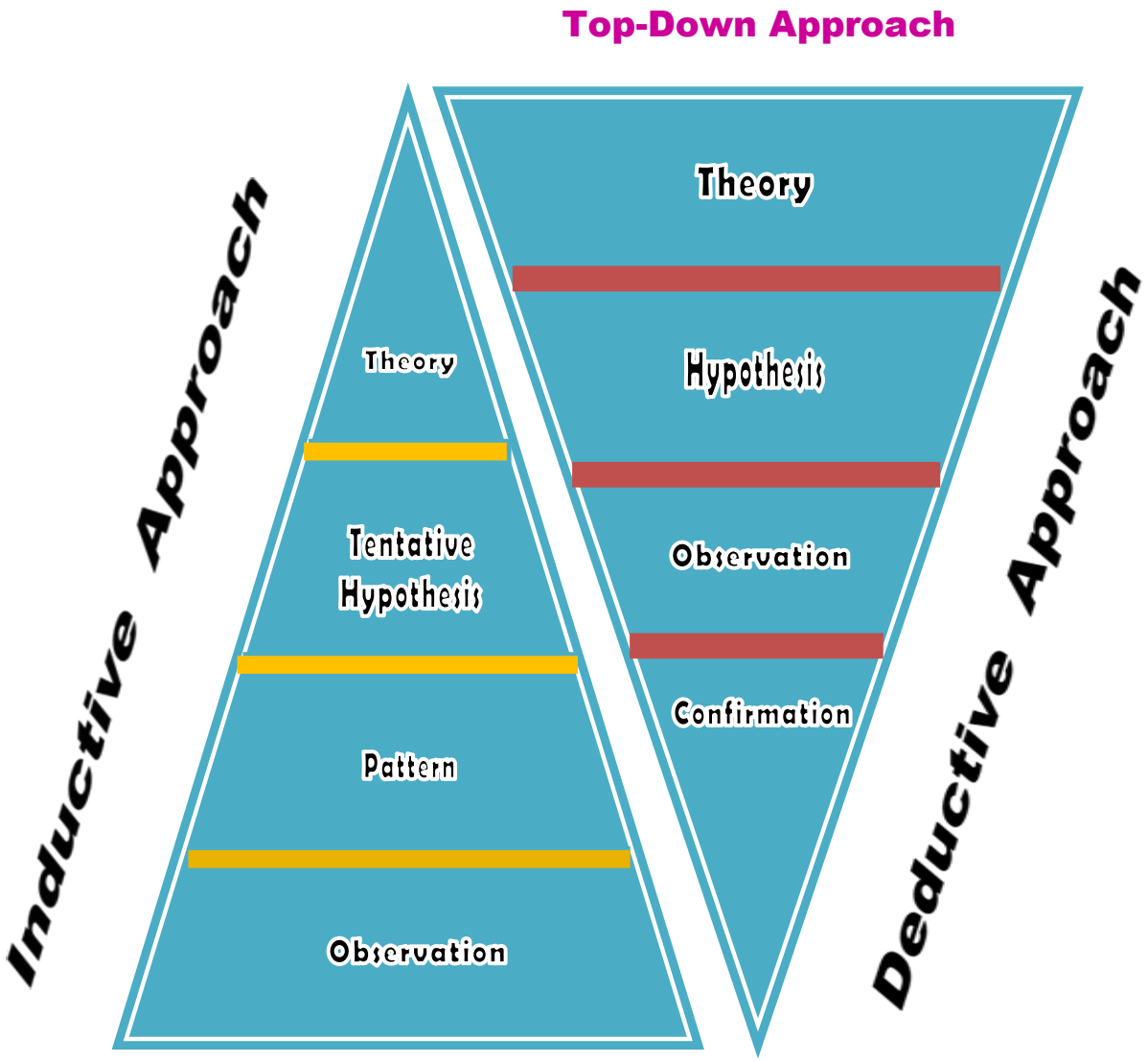


Fig. 3: Inductive and Deductive Approaches

Source: Trochim (2006)

The phrase "top-down" conjures up images of an inflexible boss giving orders and policies to subordinates rather than inspiring and enabling team members to allow their brilliant ideas to

emerge from the "bottom-up" in organizational management. In the process of developing and expanding a field data collection and analysis system, a "top-down" approach is just one of two techniques utilized to collect data and achieve the same objective: compiling and interpreting field data to support business choices. Neither technique is superior to the other. In terms of optimization and scalability, each of these data collection techniques has advantages and disadvantages. Both strategies can be fairly straightforward: the bottom-up strategy starts at the specific and works its way up to the general, and the top-down strategy goes from the general to the specific. These techniques can be applied to a variety of tasks, including forecasting, budgeting, and goal-setting. Knowing the subtle differences between the two is crucial because in the financial industry, analysts and entire companies might be assigned to prioritize one over the other (Trochim 2006).

Top-down data collection methods entail defining an overall system of data collection and analysis before going into detail and developing subsystems within it. Subsystems beneath these subsystems may be even more intricate and sophisticated, depending on the situation. For information gathering, for instance, this might entail first developing a reporting system for the management team and then outlining the process by which the field employees provide the data to the management. In general, the term "top-down analysis" describes the process of making decisions based on comprehensive factors. The top-down method looks for the overall picture and all of its elements. These elements typically serve as the catalyst for the final result. Top-down and the term "macro" or macroeconomics are frequently used interchangeably. Macroeconomics is a branch of economics that examines the primary variables influencing the overall state of the economy. These variables frequently include the federal funds rate, inflation rates, unemployment rates, and gross domestic product of the nation and the world. An analyst who is looking at things from the top down wants to see how systematic factors impact a result. In the context of corporate finance, this can entail being aware of how broad trends impact the sector as a whole. The same idea can be used to forecast, set goals, and understand and control macro factors in budgeting and goal-setting.

Bottom-up data collection techniques include assembling field-level systems to create more intricate systems higher up the information ladder; in the process, these initial systems

become subsystems in the final design. This means that before joining the elementary or bottom rung systems to form the larger system, they must be thoroughly developed. In the context of information gathering, this would entail developing a model for field workers to collect data and then determining how that information will be sent to the management team. The bottom-up analysis employs an entirely different methodology. The bottom-up approach typically concentrates its analysis on particular features and minute details of a single stock. Bottom-up investing focuses on the fundamentals of individual businesses or sectors. By examining the peculiarities of a company's characteristics and its market valuations, this research aims to find lucrative opportunities. Research for bottom-up investing starts at the corporate level but doesn't end there. These analyses give a lot of weight to the company's fundamentals, but they also consider the industry and microeconomic variables. Therefore, bottom-up investing may be quite general across an industry or extremely focused on identifying critical characteristics. When it comes to utilizing collected data, all the system design in the world won't help data collection and analysis efforts if there is no a clear idea of the purposes for using the data as well as how it will help the organization develop a data culture and provide business insights (Shakil, 2019 and Bryman and Bell, 2007).

This study employed **a top-down methodology** in examining the literature on sustainable development from a broad perspective before focusing on issues and mitigation. Additionally, secondary research on the essential elements for enhancing sustainable implementation as well as its difficulties was conducted. After that, theories and hypotheses were put to the test by observation and data gathering

The theory of top-down processing entails viewing the world through the lens of one's past experiences and knowledge. To put it another way, new information is interpreted in light of existing knowledge. It describes how the brain interprets new sensory data by drawing on pre-existing knowledge and expectations. The brain uses prior concepts, ideas, and knowledge to make sense of sensory input rather than interpreting the world exclusively from the data collected by our senses. Although there are innumerable sensory stimuli around us all the time, there is still finite intentional and processing capacities in man. Since top-down processing enables one to quickly interpret and comprehend the surroundings, it is essential to perception. Decisions can be made and responses can be given promptly as needed by

doing this. This article delves deeper into top-down processing and examines some of the variables that may affect its operation (Bryman and Bell, 2007).

The process of solving a problem by starting with the solution and working backward to support or refute it is called hypothesis-driven problem solving. When assumptions are made about what the answer is and then gather facts to support or contradict them, it is called a hypothesis-driven approach. This keeps the researcher from "boiling the ocean" by concentrating the data collection efforts on precisely what is needed and ensuring that thinking is rigorous and structured and that every angle of the issue is considered as beneficial (Bryman and Bell, 2007).

In deductive research, a theory, hypothesis, or generalization is the starting point, and it is subsequently tested through observation and data collection. Using a top-down approach, the researcher formulates a general hypothesis before testing it with detailed observations. Deductive reasoning proceeds from the general to the particular. This method is sometimes colloquially referred to as "top-down." Developing a theory regarding the area of interest could be the first step. Then, focus is more on theories that could be verified. When observations are gathered to test the hypotheses, there is possibility of getting even more specific. In the end, this enables one to test the theories using particular data, obtaining a confirmation (or not) of our original theories (Bryman and Bell, 2007).

3.2.3. Research Methodological Choice

Two primary research options are highlighted by Saunders, Lewis, and Thornhill (2009): the multiple approaches and the mono technique. The single data collection and analysis that makes up the mono technique can be either quantitative or qualitative. Numerical values are produced or used by quantitative data analysis or gathering methods (Bryman & Bell, 2007). On the other hand, qualitative data refers to any method of gathering data (like interviews) or method of analysing data (like classifying data) that produces or utilizes non-numerical data (Saunders, Lewis, and Thornhill 2009). The multiple method, as opposed to the mono method, employs several data collection strategies and analysis processes (Saunders, Lewis, and Thornhill (2009).

In summary, this thesis, as previously stated, aims to collect primary data through two methods: a stakeholder-based survey (quantitative data collection) and expert interviews and focus groups with stakeholders (qualitative data collection).

Therefore, a **mixed-method research design formed the basis of this investigation.**

3.2.4. Research Strategies

According to Saunders, Lewis, and Thornhill (2009), there are seven research strategies. These are the following:

- **Experiment**

Experimental research is defined as a study that employs two sets of variables and a scientific technique. You can measure the differences of the second set by using the first set as a constant. For instance, experimental procedures are used in qualitative research. The facts must be ascertained before making any conclusions if there is insufficient data to do so. This study collected the information required to assist in making more informed decisions (Saunders, Lewis, and Thornhill 2009).

- **Ethnography**

One often-used method for gathering qualitative data is ethnography. Data are obtained through observations and interviews to conclude the operations of societies and individuals (Saunders, Lewis, and Thornhill 2009). Rather than attempting to alter life in a laboratory, ethnographers watch it as it unfolds. Because life is unpredictable, ethnographers frequently find it difficult to put their initiatives into a procedure that the Board can approve (Saunders, Lewis, and Thornhill 2009). However, for the Board to accept a study, it must provide a thorough justification. It will enable the Board to accept studies where some flexibility is required if they can assist in understanding the study's parameters, the circumstances in which participants will be contacted and will participate, and the risks associated, the study advice.

- **Case Studies**

According to Saunders, Lewis, and Thornhill (2009), a case study is a type of qualitative design where the researcher thoroughly examines a program, event, activity, technique, or one or more individuals. The case(s) are constrained by time and activity, and researchers gather comprehensive data over an extended period utilizing a range of data-gathering techniques.

- **Action research**

Saunders, Lewis, and Thornhill (2009) believe that the method of action research is used to enhance instructional strategies. Action, assessment, and reflection are all part of its methodology. It is a procedure to collect data to make practice changes, the study discloses. Action research is also a cooperative and participatory process. It is carried out by people who have a shared goal.

- **Archival Research**

Archival research is the process of locating and acquiring evidence from archive records (Saunders, Lewis, and Thornhill 2009). These records may be kept in the collections of collecting institutions, like libraries and museums, or in the care of the original organization that created or gathered them, be it a government agency, business, family, or other entity, or in the care of a successor organization (transferring, or in-house archives). Comparing archival research to other forms of primary research and empirical investigation, such as fieldwork and experiments, as well as secondary research (conducted in a library or online) that entails locating and reviewing secondary sources relevant to the subject of inquiry, can help clarify differences (Saunders, Lewis, and Thornhill 2009). It might be difficult to find, locate, and analyse pertinent documents when conducting archival research because it is typically more complex and time-consuming than secondary research.

- **Survey**

Survey research is often defined as a quantitative approach that uses a series of survey questions to gather data from a group of respondents. This kind of research entails data gathering, analysis, and participant recruiting (Saunders, Lewis, and Thornhill 2009). Researchers who want to inform their respondents about novel features or trends can benefit from it. It's usually the first stage in gathering quick information about popular subjects and initiating more thorough qualitative or quantitative research techniques, such as focus groups, on-call interviews, or surveys and polls.

- **Grounded Theory**

A popular methodology used in many research projects is grounded theory. In a grounded theory study, data generation methods can be both qualitative and quantitative. The goal of grounded theory is to generate or develop theory from data that has been methodically collected and examined through comparative analysis. Grounded theory is a sophisticated methodology despite its inherent flexibility. As a result, inexperienced researchers make an effort to comprehend the language around grounded theory concepts and procedures (Saunders, Lewis, and Thornhill 2009).

In conclusion, a case study and survey were applied in this study. According to its definition, a case study is "a research strategy that conducts an empirical investigation of a particular phenomenon within its real-life context using multiple sources of evidence’. Researchers could obtain a large quantity of data in a very cost-effective manner by using surveys (Saunders, Lewis, and Thornhill 2009). Focus groups with construction industry professionals and case studies in the form of in-depth one-on-one interviews with experts were held to meet the research objectives. In addition, a survey of stakeholders was conducted as part of this study to find out how they felt about the challenges associated with implementing sustainable practices in the construction industry. This resulted in the widely used triangulation approach.

Expert interviews were conducted to identify appropriate, novel solutions based on gaps in the current sustainability development space in the construction sector; to meet the goals of this study. The construction industry specialists participated in focus groups and one-on-one interviews to help narrow down potential cutting-edge sustainable implementation methods for the segment. Another name for this research strategy option is 'methodological triangulation'. Saunders, Lewis, and Thornhill 2009) noted that the benefit of the methodological triangulation employed in any research is that it contributes to the improvement of validity and reliability as well as the expansion of knowledge and comprehension in the selected study field and prevents incorrect interpretation of the data gathered (Bryman and Bell, 2007; Saunders, Lewis, and Thornhill 2009).

3.2.5. Time Horizons

A research study's time horizons show the duration of the investigation that is being conducted. On the basis of this, Saunders, Lewis, and Thronhill (2009) created two classifications: cross-sectional and longitudinal. A cross-sectional study looks into a particular topic within a specific time period, and its goal is to give an overview of a situation that is still developing (Saunders, Lewis, and Thronhill, 2009). Longitudinal research involves conducting studies over a longer time frame. Observing and examining changes and developments in a particular issue is the goal of this research (Saunders, Lewis, and Thornhill, 2009). Because the study had to be finished in two years, qualitative and quantitative data were collected at certain intervals rather than over an extended period of time. As a result, the temporal horizon for this study is defined as **cross-sectional**.

3.2.6. Research Techniques and Procedures

According to Saunders, Lewis, and Thornhill (2009), the methodology is the set of beliefs that determines how research should be conducted to accomplish the stated goals. The methodology calls for developing a theory and offering the tools required to ascertain the hypothesis to accomplish the research's goals. This thesis examined the issues of sustainability and regeneration that the construction industry faces today. The study followed Saunders, Lewis, and Thornhill (2009) advice in conducting its research to achieve its goal.

The report suggested that the research would be implemented by asking questions about stakeholders' intentions to implement sustainable practices.

The distinctions between exploratory, descriptive, and explanatory research are made by Saunders, Lewis, and Thornhill (2009). When a study's goal is to make sense of a situation, exploratory research is employed. According to Collis and Hussey (2009), the exploratory research approach is used when there aren't many studies on the topic that the researcher can consult for information. Robson (2002) states that, the goal of descriptive research is "to portray an accurate profile of events, or situations." The goal of the explanatory study is to determine the causes of various variables. Descriptive and explanatory research uses quantitative data, while exploratory research combines a literature review with qualitative data from expert interviews and focus groups.

To develop potential applications in the construction sector, this study explored the current issues surrounding sustainability and regeneration. This was accomplished by fusing the results of the literature study with quantitative data from a stakeholder-based survey and qualitative data from expert interviews. Thus, this research was done for exploratory and descriptive as well as explanatory purposes (Robson 2002). Due to the mixed-methods methodology of this study, quantitative and qualitative data were combined. Interviews with top construction managers, owners of construction companies, and heads of top construction departments were done. Stakeholder-based surveys came next, and a focus group with stakeholders came to an end. In-depth expert interviews to identify a shortlist of potential solutions were conducted. Followed by stakeholder focus groups to further refine the selections and extract compelling ideas for the creation of novel sustainable development solutions. Stakeholder-based surveys were then employed to confirm the efficacy of the tools created.

3.2.6.1. Data Collection

To address the research issues, this study first gathered secondary data on the following subjects: economic benefits of sustainability, perceptions of stakeholders regarding

sustainable construction, the role of stakeholder perspectives, economic incentives to promote sustainable implementation, economic benefits influence on decision-making process, necessity for corporate sustainability, regulatory bodies influence on the economic benefits, social and environmental co-benefits, championing sustainability at work, stakeholders views on sustainability practices, need to be rich to be sustainable, design thinking on sustainable development, stakeholders comparison of sustainability with ESG (environment, social, and governance, and sustainability challenges and their remedial strategies for a sustainable future.

The primary purpose of conducting secondary data in this section was to establish the foundation of the study's literature review. The majority of the secondary data included in this section came from online sources as well as books and peer-reviewed publications. In addition, preliminary secondary data research was carried out in this study to establish a methodology and to furnish details regarding sustainability within a global framework. Furthermore, secondary research aided in the identification, comprehension, and analysis of the sustainability implementation methodologies currently used by the construction sector through the availability of Internet and print material. Currently, the majority of the information used to create methodology literature came from reading peer-reviewed research publications like Saunders, Lewis, and Thornhill (2009) and Collins and Hussey (2009). The primary data sources used to produce the global sustainability analysis were online resources. To respond to the predetermined research questions, this study also used primary data collecting system.

3.2.6.2. Instruments for Research

Questionnaires, focus groups, or one-on-one interviewing techniques were selected as the key data collection instruments. During an interview, which was a method of gathering data, the researcher asked respondents open-ended questions, as stated by Nanda (2005). By asking respondents to define the circumstance, the researcher tried to collect the relevant data. There were three main ways to formulate interviews: semi-structured, non-structured, and structured (Thomas, McGee, & Wilson (2010). A list of questions and themes were provided for the semi-structured interviews that would be done for this study. The format of the interviews

was one-on-one or focus group. Data from prominent departmental managers, heads, and business owners, as well as industry professionals serving as project managers for the worldwide construction sector, were gathered for the study through interviews and questionnaires. However, it was thought that gathering knowledge from professionals in the field would be extremely beneficial in creating the most effective tactics for sustainable implementation.

The goal of every interview is to better understand the part that the stakeholders played in successful implementation of sustainable development. One would be aware of the many campaigns for sustainable implementation methods that were conducted by companies that in the world. The evaluation of the participant's reaction to the global problems associated with the adoption of sustainable practices would be based on the opinions of the relevant stakeholders and the degree to which the segment's companies around the world would have their sustainability policies evaluated. Important lessons, success elements, areas for progress, and failures are recognized. Exceptionally creative tactics are acknowledged. Additionally, a subjective evaluation of the campaigns' effects on expenses, and top and bottom lines was conducted. Research is being done on other global best practices in sustainability that the building sector may implement or modify. Depending on the interviewee's availability and place of residence, all interviews took place either in person or over the phone. To evaluate the creative solutions that could be used for sustainable implementation, a comparable group of expert interviews—experts from the construction industry only—were scheduled.

This primary data collection method was chosen because, using the same set of questions, a sizable number of people's perceptions could be obtained regarding sustainable practices and strategies used by the construction industry around the world. These strategies were identified through one-on-one interviews with experts and secondary research. The questionnaire, which was semi-structured in nature, consists of questions that defined sample characteristics. In addition, additional inquiries were made to find out how the stakeholders viewed the sustainability section. Stakeholders in the construction industry in South Africa are consulted regarding the effectiveness of sustainable practices. The study used a three-point Likert scale, which goes from disagreement to agreement, to record the range of responses. Scale 1 indicates disagreement, scale 2 is Neutral, and scale 3 is Agreement.

Matell and Jacoby (1971) discovered that the validity and reliability of research questionnaires are unaffected by the number of scale points employed. Every level on a three-point rating scale offers participants the least amount of ambiguity and a clear definition to help them make a decision. To give every individual in the target population the chance to make a decision, sampling uses a probabilistic sampling technique. This methodology is utilized due to its potential to yield results that are inclusive of the total population. To assess a questionnaire's reliability, the utilized Cronbach's alpha. A dependability score of 0.7, 0.8, and 0.9 indicates a satisfactory, acceptable, and exceptional level of reliability, respectively. Any value below 0.7 indicates unreliability. A questionnaire is regarded as reliable when survey results are consistent and it measures the intended outcome accurately. In this case, the researcher is in complete charge of gathering data.

Table 1: 3 Point-Likert scale factors

Scale	Factor
Agreement	3
Neutral	2
Disagreement	1

Source: Matell and Jacoby (1971)

The study model and hypothesis were investigated with the aid of the survey. Since it's critical to maintain focus on the goals and objectives of the study, questions were typically developed concerning the following three variables. "An independent variable also known as a "regressor, controlled variable, or input variable" causes changes in a dependent variable; Confounding variables, often referred to as extraneous variables, have an impact on the variables under study, causing the results to not accurately reflect the true relationship between the variables. A dependent variable which is also referred to as a response variable or output variable exhibits variability in response to changes in other variables. The confounding variable is the third variable that affects independent and dependent variables (Saunders, Lewis, and Thornhill 2009). Since the results or responses from the participants would be used to form a conclusion, the study's questions were constructed based on dependent variables.

3.2.6.3. Sampling

Sampling is defined as the act, process, or technique of choosing an appropriate sample, or a representative portion of a population, with the aim of ascertaining parameters or characteristics of the entire population by Jopnes (1955) and Salant & Dillman (1994). A crucial component of any research project is sampling. Selecting the appropriate sampling technique is crucial for addressing a particular research question, as it can determine the research's validity. Sampling is also the process of choosing specific individuals or a subset of the population to estimate the characteristics of the entire population and draw statistical conclusions from them. Researchers frequently employ a variety of sampling techniques in their work to avoid having to study the complete population to obtain useful insights. It is the cornerstone of any research design since it is a time- and money-efficient approach.

In this study, the population was defined and a subgroup was chosen for the study to analyze the research topic. A population is all of the elements in the groupings that the researcher is looking into (Venkatesh & Davis 2000). Thus, the study's population consisted of professionals in the construction industry. Because the population is too large, the sampling technique was utilized in this study to cut down on the time and effort required to complete it.

According to Venkatesh & Davis (2000), the majority of statisticians concur that a sample size of 100 is required to produce any sort of significant result. The researcher must survey every member of the population if there are fewer than 100. As long as the sample size stays under 1000, 10% of the population is typically a good maximum sample size. For instance, 500 people would make up 10% of a population of 5000. Ten percent of 200,000 would be 20,000 people. Since this is more than 1000, 1000 would be the maximum in this instance. A sample size of 1000 individuals will typically yield a reasonably accurate result, even in a population of 200,000. Because it would take more time and money to sample more than 1000 people, the accuracy won't increase much.

Because of the time and monetary constraints for this study, the researcher had to find a solution to shorten the time and expenses required. As a result, non-probability sampling

techniques also referred to as non-scientific techniques were used (Ekwuno and Dr. Nel, 2022). This has to do with case studies and qualitative research methodologies. To ensure that a real instance is determined, qualitative study mostly focused on small samples. In this case, no representative sample is needed. The study merely required a precise justification for including some respondents (Ekwuno and Dr. Nel, 2022). Figure 4 below shows the sampling techniques implemented in this study.

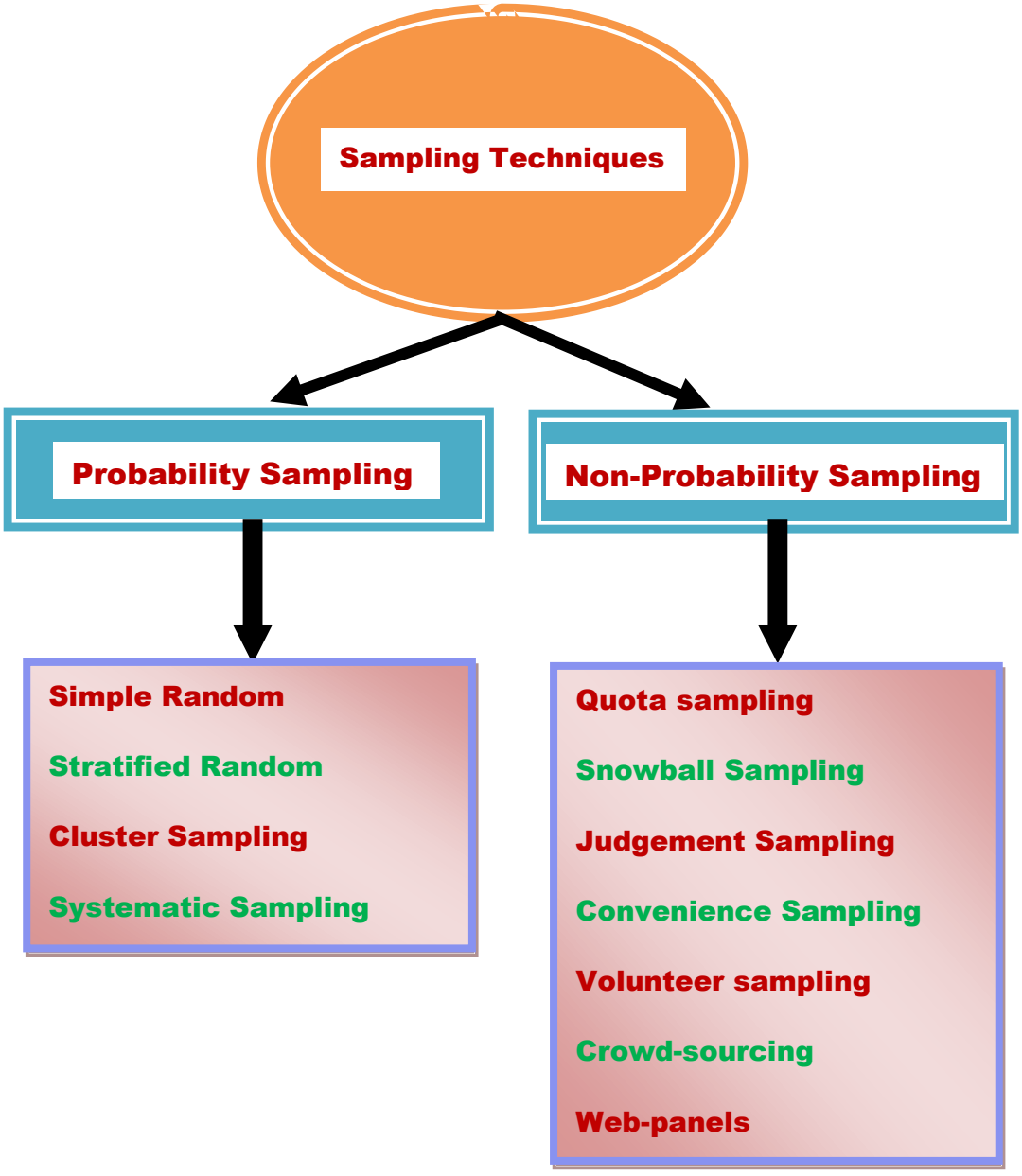


Fig. 4: Sampling Techniques

Source: Ekwuno and Dr. Nel (2022)

1. Probability sampling

According to www.surveymonkey.com/mp/probability-sampling/, probability sampling is a technique where a method based on probability theory is used by the researchers to select samples from a larger population. Participants' selection by random selection is a prerequisite for being classified as a probability sample.

Using a known, non-zero probability, each member of the population is given a known chance of being chosen when a sample is chosen from the population. All members of population must have an equal and known chance of being selected for probability sampling to work. With probability sampling, a small subset (sample) of an already existing large population is chosen at random using statistical theory, and it is hypothesized that all of their responses will be consistent with the population at large. The general category of probability sampling includes several different sampling techniques. These approaches differ according to the kind of study you're conducting and the kind of information you hope to gather, as well as the time and resources available to you. The four primary probability sampling approaches that researchers employ are as follows:

- **Simple random sampling**

Simple random sampling involves random selection and gives every member of the population an equal chance of being chosen. To accomplish this, researchers may choose individuals from the general population to be included in a sample using instruments like a random number generator. As the name suggests, simple random sampling is the most straightforward sampling technique, but it is also subject to bias. For instance, there is less chance that a trustworthy sample will be selected at random if the sample size is smaller than the size of the total population.

- **Stratified random sampling**

Numerous populations can be further subdivided into smaller groups according to distinct attributes that, when combined, represent the entire population but do not overlap. One would take a sample independently from each of these groups, or strata, using stratified random sampling. Compared to simple random sampling, this ensures that each subgroup is accurately represented, producing more accurate results. Stratifying based on factors like sex, age, income level, or ethnicity is prevalent. The strata must be distinct and exclusive, which

means that each member of the population should only belong to one group. Following the stratification of the population, one would choose a subset of individuals, proportionate to the entire population, using simple random sampling. After that, those people would be merged into a single sample.

● Cluster sampling

Cluster sampling, like stratified sampling, is dividing the population into smaller groups, or clusters. That's where the two approaches to probability sampling diverge, though. Each cluster in a cluster sampling should resemble the population in some way. One would start by choosing entire clusters at random rather than picking people from every cluster. Try to have as many members of each chosen cluster as possible in your final sample. One would have to choose people at random from each cluster if they are too big. Researchers frequently employ readily accessible, pre-existing groups as clusters. Geographic boundaries, such as those of cities or counties, are usually the basis for this, but office buildings or schools may also be used. When surveying populations that are extremely large or dispersed geographically, cluster sampling is most frequently used to reduce costs. Cluster sampling, however, carries a higher risk of sampling error. Although it can be challenging to ensure, each cluster is meant to represent the entire population.

● Systematic sampling

While systematic sampling is typically a little simpler to carry out, it is comparable to simple random sampling. Every person in the population is given a number, and then a sample is chosen at regular intervals. (Interval sampling is another name for systematic sampling.) Stated differently, each “nth” member of the population is chosen to comprise the sample. In a population of 1,000, for instance, one may select every ninth individual for your sample. Compared to other sampling techniques, this one may be easier to understand because the process of selecting participants is methodical and straightforward and does not rely on a random number generator. Conversely, if a generator is employed, the selection that is produced might not be as random as it otherwise would be. Furthermore, it's critical to confirm that the list is free of any hidden patterns that could skew the random selection. The sample will be skewed and you might have too much or too little representation in it if there is a chance of data manipulation. Let's take an example where you have an employee survey planned for a specific organization and the employees are listed alphabetically. To choose

every fourth employee for your sample, you intend to employ systematic sampling. But, you risk selecting too many or too few individuals in senior roles if the alphabetical list is additionally arranged by team and seniority. In this case, there is a possibility of bias in the sample.

Probability sampling benefits

The use of probability sampling has various advantages. Large audiences that are representative of the target buying audience can be sampled at a reasonable cost overall. It benefits geographically dispersed populations as well. Every kind of probability sampling has benefits of its own. For instance, cluster sampling restricts the variability in a research study, stratified sampling lessens researcher bias, and basic random and systematic sampling facilitates the implementation process. Using probability sampling with an agile experience management platform doesn't require much technical knowledge. When using stratified sampling or systematic sampling to create the population sample, one can also be as specific as possible. Cluster sampling and simple random sampling are the best options if one is under time pressure.

Probability sampling's limitations

Every benefit has a specific detail that could undermine the entire effort. For example, conducting a little more research, which will require more time and resources, is necessary to obtain the best possible population sample. While stratified sampling can guarantee that each cluster is represented fairly, it might not capture every variation within the sample population. The strata can be divided into a variety of clusters through cluster sampling, but those clusters may share traits. The results of simple and random probability sampling can be obtained quickly, but the strata and clusters may not be as focused on your target market.

When to apply probability sampling

For quantitative studies where the objective is to use statistical analysis to make conclusions about a large population, probability sampling is perfect. When surveying the entire

population would be too costly or time-consuming, researchers can use this sampling strategy to get representative data. Many market research studies use probability sampling to obtain information from a sizable population. Projects like these include figuring out how consumers use products and what influences their decisions most, as well as researching consumer behaviour, and determining new players and categories in the industry Probability sampling gives businesses access to data that reflects their entire target market, which helps them solidify new ideas and enhance operations even beyond industry tracking, buyer attitudes, and competitive intelligence. Probability sampling is an excellent method for managing a sizable population, such as thousands of coffee shops. Larger samples with true probability lessen the possibility of sampling error, which happens when you choose a sample that is not representative of the entire population. Furthermore, because random sampling takes a methodical approach to sample selection as opposed to a subjective one, it can generally reduce sampling errors (Ekwuno and Dr. Nel, 2022).

2. Non-probability sampling

The process of choosing units from a population in a non-random, subjective manner is known as non-probability sampling. It is quick, simple, and affordable to collect data using non-probability sampling since it does not require a full survey frame. Nonetheless, it is necessary to presume that the sample is representative of the population to make inferences about the population from it. Due to the challenge of determining whether the assumption is true, this is frequently a dangerous assumption to make in the context of non-probability sampling. Furthermore, there's no way to calculate the likelihood of any individual element being included in the sample because elements are selected at random. Also, there is no guarantee that every item will be included, which makes it hard to estimate sampling variability or spot potential bias. Probability sampling has typically been the method of choice for official statistical agencies all over the world to meet information needs regarding a population of interest. However, there have been some studies and research in the past few years regarding the incorporation of non-probability sampling into official statistics (https://www150.statcan.gc.ca/n1/edu/power-pouvoir/ch13/nonprob/5214898-eng.htm).

The use of other data sources is becoming more popular. This trend can be attributed to five main factors:

● the rise in non-probability data sources like web surveys and social media. ● the fall in response rates in probability surveys. ● the high cost of data collection. ● the heavier load on respondents and ● the need for access to real-time statistics.

There have been suggestions that the paradigm and conventional approach to statistics may change. However, there are certain issues with data quality associated with non-probability sources, such as the possibility of selection bias and participation. Non-probability sampling data should therefore be used with additional caution. Non-probability sampling, however, is at the other extreme of the sampling technique spectrum. Even if you are adamant about selecting your sample randomly, it is still important to understand the fundamentals of non-probability sampling, including when and why researchers employ it. Members of the general population do not have an equal chance of being included in your sample when using non-probability sampling and the process of choosing them is not random. Some members won't even have the slightest chance of getting chosen. Non-probability sampling is frequently used for exploratory and qualitative research that is more focused on hearing from people with specific expertise, experiences, or insights, whereas probability sampling is concerned with concluding a larger population (Ekwuno and Dr. Nel, 2022).

Assume, for instance, that one is studying the local use of mobility ramps and that the wheelchair-using population in the city is the population of interest. One is unable to use probability sampling because there is no complete list of these individuals. But a few people are met who consent to take part in your research, and they connect other local wheelchair users. While snowball sampling, a non-probability sampling technique, might not entail random selection, it can help one connect with more relevant individuals for your study. Compared to probability sampling, non-probability sampling is typically simpler and less expensive to carry out, but it also carries a larger risk of sample bias. This is so because, rather than using randomization, the sample selection procedure is founded on the researcher's subjective assessment. Furthermore, neither the sample size nor the outcomes have to accurately reflect the entire population (Ekwuno and Dr. Nel, 2022).

The following are examples of non-probability sampling techniques that are frequently used.

● Quota sampling

One of the most popular types of non-probability sampling is Quota sampling. Sampling continues until a predetermined number of units, or quotas, for different subpopulations are chosen. One way to achieve the sample size goals for the subpopulations is through quota sampling. The quotas might be determined by the population ratios. Ten men and ten women might be interviewed, for instance, if the population is made up of 100 men and 100 women and a sample of 20 is to be taken. Quota sampling is deemed better than other non-probability sampling techniques (like judgment sampling) since it compels participants from various subpopulations to be included. Because similar units are grouped, stratified sampling, which is probability sampling, and quota sampling share some similarities. The way the units are chosen is different, though. While quota sampling uses a non-random method—usually leaving it up to the interviewer to decide who sampled— probability sampling selects the units at random. Unwilling units that are contacted are simply replaced by units that are effectively disregarding no response bias. When interviewing people who fit specific socioeconomic profiles, market researchers frequently utilize quota sampling rather than stratified sampling, especially when conducting telephone surveys. This is because quota sampling when compared to stratified sampling, is more affordable, simpler to implement, and has the advantageous ability to satisfy population proportions. It does, however, mask potentially large selection bias. As with all other non-probability sample designs, it is necessary to assume that the people selected are similar to the people who were not selected to conclude the population. Strong presumptions like these are rarely true.

● Snowball or network sampling

Assume a researcher is looking for unique people in the population and is aware of some of these people's existence as well as how to get in touch with them. One strategy is to get in touch with those people and inquire if they know anyone similar to them, then follow up with those people, etc. Like a snowball rolling down a hill, the sample expands in the hopes of including almost all people who possess that attribute. Snowball sampling is helpful for hard-to-reach or uncommon populations, such as drug users, homeless individuals, people with disabilities, and other individuals who might not be part of a formal organization or who are not easily recognized on a survey list frame. Some people or groups, nevertheless, might not

have a chance of being included in the sample. Certain presumptions must be met to be able to generalize the conclusion to the entire population, and these are typically unmet.

● Judgment sampling

Using this approach, sampling is carried out using preconceived notions about the makeup and behaviour of the population. Which population units should be sampled is a decision made by a population expert. Stated differently, the expert deliberately chooses what is deemed to be a representative sample. Judgment sampling is biased, possibly even more so than haphazard sampling, and is susceptible to the prejudices of the researcher. If the researcher's preconceptions are false, significant biases may be introduced because the sample reflects the researcher's beliefs. Nonetheless, it can be helpful in exploratory research when choosing participants for in-depth interviews or focus groups to test particular elements of a questionnaire.

● Haphazard sampling or convenience

Planning is minimal or non-existent when choosing units; the process is random. Any unit may be selected for the sample in haphazard sampling since it operates under the assumption that all population units are similar. A Vox pop survey, in which the interviewer chooses participants at random, is an example of haphazard sampling. However, the selection is vulnerable to the prejudices of the interviewer and anyone who happened to pass by when the sample was taken unless the population units are comparable.

● Volunteer sampling

In this method, the respondents are purely voluntary. In general, screening is required to obtain a set of characteristics from volunteers that are appropriate for the survey (e.g., individuals with a particular disease). Although there may be significant selection biases with this method, it is occasionally required. For certain medical experiments, for example, it may be necessary to solicit volunteers with specific medical conditions due to ethical concerns. Volunteer sampling can also occur when listeners are invited to call in to share their opinions during a discussion of a topic on a radio or television program. Reactions are typically limited to those who have a strong enough interest in the topic. A significant selection bias is produced because the silent majority rarely responds. Choosing participants for focus groups or in-depth interviews—that is, for qualitative research in which there is no attempt to generalize to the entire population—often involves the use of volunteer sampling.

● **Crowd-sourcing**

Scholars from different fields have given slightly different definitions to crowd sourcing. Although the term "crowd sourcing" has been defined in many ways, one thing that has remained consistent is the public broadcasting of a problem and an open call for contributions to aid in its solution. Public submissions of solutions become the property of the entity (individuals, businesses, or organizations) that first publicized the issue. By using crowd-sourcing, experts can channel their desire to solve an issue and then freely share the solution with everyone (Ekwuno and Dr. Nel, 2022).

● **Web-panels**

An access panel of people willing to answer online questionnaires is known as a web panel, also known as an online or internet panel. It includes a sample of prospective respondents who affirm that, should they be chosen, they will assist with future data collection. A survey that uses web panel samples is known as a web panel survey. For web panel surveys, web panels can be thought of as sampling frames. Every individual in the panels needs to have a current email address. Several methods can be used to recruit for web panels. Offline channels such as the phone, TV, radio, newspaper, and magazine advertisements, addressed letters, outdoor posters, customer registers, and so on can be used to find respondents. Online channels such as emails, websites, banner ads, community sites, member programs, etc. can also be used to find respondents. In order to achieve the required diversity, numerous channels are frequently used. Following the recruitment process, a profile survey is carried out to gather data about the new panel members. Either self-recruited panels or probability-based panels can be used for the recruitment process. In actuality, if the probability-based panels' non-response rate is very high, the difference between these two might not be all that significant. Incentives like gift cards or mementos are occasionally used to draw attendees and increase response rates. Pilot studies and marketing research frequently use web panels (Ekwuno and Dr. Nel, 2022).

Advantages of non-probability sampling

• **Timely and practical:** Generally speaking, non-probability samples can be assembled fast, enabling the survey to be initiated, carried out, and completed more quickly.

• **Low-cost:** Such a survey typically takes a few hours to conduct for an interviewer. Additionally, since non-probability samples are typically not geographically dispersed, interviewers' travel costs are minimal. Interviewers are not required for web panels or crowd-sourcing. It is neither less demanding nor necessary to track down and convince non-respondents.

• **Lessen the load on respondents:** When using volunteer sampling or crowd-sourcing, survey participants offer their time to take part in the study without being specifically asked.

Disadvantages of non-probability sampling

• **Bias in selection:** Even though the respondents are self-selected, it takes strong assumptions about the similarity between the sample and the population in order to draw conclusions about the latter. These are frequently risky assumptions to make since all non-probability samples exhibit selection bias. Use probability sampling instead of generalization to the entire population when making such a determination.

• **Bias in non-coverage (under-coverage):** Non-coverage bias occurs because certain population units may not have a chance of being included in the sample. Those without access to the internet at home, for instance, might never be chosen for a web panel and might not be like those who do.

• **The challenge of evaluating the quality:** It is not possible to compute accurate estimates or estimates of sampling error since it is impossible to ascertain the probability that a unit in the population will be chosen for the sample (https://www150.statcan.gc.ca/n1/edu/power-pouvoir/ch13/nonprob/5214898-eng.htm).

In conclusion, convenience and volunteer sampling are one of those approaches used in this study, and as a result, 118 construction professionals out of a total population of 200 responded to the questionnaire (Ekwuno and Dr. Nel (2022). A probability mechanism is not used in convenience sampling in order to make a selection. This is a simple and inexpensive

strategy to use. Applicants are selected for convenience and volunteer sampling based on how easily and frequently they are available. By employing this system, research effort encounters fewer roadblocks. For example, it is simpler to include friends or family in a sample than it is to specifically target strangers (Ekwuno and Dr. Nel 2022). On the other hand, a sample is a subset of responders selected to be typical of the total population.

The questionnaire approach was determined to be a fairly appropriate instrument for this study, as the researcher aimed to reach out to a minimum of 200 construction professionals. In actuality, the researcher saved time by using this approach. In order to obtain the necessary number of respondents for this study, the researcher used a straightforward sampling technique known as convenient sampling for the questionnaire distribution. Snowball sampling, which involved sending out emails to stakeholders, was used to get more responses. The questionnaire was distributed by the thesis's researcher using Survey Monkey, hand delivery, and email.

This study also considered the margin of error of 5%, confidence level of 95%, and z-score of 1.96 in calculating the sample size. However, the sample size for this investigation was determined using the simplified formula below:

s = 6Pze

s = Sample Size

P = Target population

e = Confidence Interval or Margin of Error or Level of Precision of 5%.

z = z-score in line with the confidence level of 95%

Table 2: Confidence Level and Margin of Error

The Sample size: for ±3%. ±5% ±7% and ±10% Precision Levels
Where the Confidence Level is 95% and e = 0.05, z-score = 1.96

Size of Population	Sample Size(s) for Precision (e) of				
	±3%	±5%	±7%,	±10%	
100 Minimum		59			
125		74			
150		89			
175		103			
200		118			
225		133			

250		**147**			
275		**162**			
300		**177**			
325		**192**			
350		**206**			
375		**221**			
400		**236**			
425		**250**			
450		**265**			
475		**280**			
500		**294**			

Table 3: Confidence Level and Confidence Interval (z)-Values

Confidence level	z-score
70%	1.04
75%	1.15
80%	1.28
85%	1.44
90%	1.65
92%	1.75
95%	1.96
96%	2.05
98%	2.33
99%	2.58

Source: http://www.ltcconline.net/greenl/courses/201/estimation/smallConfLevelTable.htm

- **Confidence intervals (z-values)**

Confidence intervals express how definite or unsure a sampling strategy is, as well as how uncertain a certain statistic is (Ekwuno and Dr. Nel 2022). To put it simply, a confidence interval shows the level of assurance that survey results accurately represent what would be expected if a population-wide survey were feasible. That is the difference between respondents' opinions and the general public's opinions. Positive or negative numbers (±) typically represent confidence intervals. 90%, 95%, and 99% are the regularly used confidence levels. Most frequently, a 95% confidence level is used by researchers, according to Ekwuno and Dr. Nel 2022).

● **Confidence level**

A researcher's level of confidence that a population will choose an answer within a certain range is expressed as a percentage. A 95% confidence level, for instance, indicates that there is 95% confidence that the outcome will fall between x and y. The proportion of time that an estimate between the upper and lower bounds of the confidence interval is predicted to reproduce another way to quantify the confidence level (Ekwuno and Dr. Nel 2022). This is what the alpha value indicates. The probability value (p-value), sometimes referred to as the statistical relevance threshold or alpha value, is unpredictable. The field of study dictates the value to be chosen. An alpha of 0.05 or less is typically used by researchers to denote statistical significance. This indicates that the data under test have a less than 5% chance of occurring under the null hypothesis; however, this threshold can be adjusted higher or lower (Ekwuno and Dr. Nel 2022). A result is unlikely to be explained entirely by chance or random circumstances if it is statistically significant. Stated differently, it is highly implausible that a statistically significant result would arise from a research project that had no meaningful impact (Ekwuno and Dr. Nel 2022).

Confidence levels and confidence intervals are frequently confused by people. The confidence level expresses a value within the range of a confidence interval. The margin of error is utilized to determine this range. How much the estimate may be off, can ascertained by looking at the margin of error. A 95% confidence level, for instance, indicates a 95% likelihood that the value is inside the confidence interval. A higher margin of error is permitted because a higher confidence level corresponds to a larger range (or interval).

● **Margin of Error**

The margin of error indicates the extent to which the opinions expressed by the general public will be reflected in the survey results. Keep in mind that conducting surveys requires striking a balance between representing a much larger group—the target market or the entire population—through a smaller one—the survey respondents. The margin of error can be used to gauge the effectiveness of the survey. There can be more confident in the results if the margin of error is smaller. The margin of error, as its name suggests, is a range of values above and below the survey's actual results. A 60% "yes" response, for instance, with a 5%

margin of error indicates that between 55% and 65% of the general public believed the answer is "yes."

According to Wu, Zhao, and Fils-Aime (2022), the response rate is the proportion of respondents who answered to the questionnaires they got out of the total number that were delivered. In other words, the number of completed surveys divided by the total number of surveys distributed and multiplied by 100 is the response rate. For instance, if 100 people received a questionnaire and 60 of them answered it, the response rate would be 60%. In the context of online surveys, a 10% to 20% response rate is typically regarded as good and a 30% response rate as very good (Ekwuno 2022). Nonetheless, it is nearly universally accepted that a response rate of 50% or more is exceptional Ekwuno and Dr. Nel (2022) indicated.

3.3. Reliability and validity of the research instrument

Validity is the extent to which an instrument measures what it was designed to measure. Whereas validity focuses on a measure's precision, **reliability** measures how consistently an instrument would yield the same results if the measurements are made again under the same circumstances. The degree to which an instrument produces consistent results after several trials is referred to as **reliability** (Ekwuno and Dr. Nel 2022).

However, the Reliability of the research instrument used in this study to gather participants' data was evaluated using Cronbach's alpha. The degree of consistency in this instance was gauged by Cronbach's alpha (Ekwuno and Dr. Nel 2022). The reliability correlation coefficient (r) is used to compute Cronbach's alpha. The intensity and direction of the linear relationship between x and y are indicated by this coefficient. According to Ekwuno and Dr. Nel (2022), using the correlation coefficient (r), one can ascertain if the sample data's linear relationship is robust enough to represent the relationships between the chosen populations. The quality of work in a quantitative study is measured by reliability. It demonstrates how accurate the questionnaires are. Reliability links to the consistency of measure. According to Taherdoost (2016), reliability is the degree to which a measurement of an event or fact yields stable and consistent results. If a test can be repeated consistently and yields the

same result, it is considered reliable. A blatant example of dependability is when the clock continues to chime every day at precisely 7 a.m. to wake someone up. Three characteristics of reliability are equivalency, homogeneity, and stability. Additionally, the quantity of observed data points included in the sample determines how reliable this linear model is. Because of this, the sample size (n) and reliability coefficient (r) were taken into account jointly in this investigation. The accuracy of a test, research tool, or rating is represented numerically by the reliability coefficient, which ranges from 0.0 to 1.0. It is easy to interpret reliability coefficients. Higher numbers indicate higher reliability.

Stability verifies that participant responses are consistent. Reactions are trustworthy when a specific respondent's answers remain consistent in comparable circumstances. When comparable outcomes are obtained, the research tool is stable and dependable.

In qualitative research, **equivalency** is used to verify participant agreement. This speaks to the extent of comparability between research findings. This method can be applied to decide where and how to use the instrument, as well as to overcome obstacles. Validity and reliability, however, are crucial factors that should be taken into account in any research project. A high-quality research study should provide proof of how each of these factors has been addressed. This aids in determining whether to use the results in the field of work.

Cronbach's α is the statistic used by **homogeneity (internal consistency)** to assess the outcomes. The split-half reliability result is divided into two halves and compared. But a highly correlated instrument is more trustworthy than one with a weakly correlated one. The split-half test employs the yes-or-no principle to provide answers. Cronbach's α is used to measure internal consistency. The agreed reliability is 0.70 and higher, and it has varied from 0 to 1. All measurements of the variable indicators must indicate acceptable internal consistency according to Cronbach's Alpha, which requires a rate of 0.70 and above (Olaniyi 2019). A rate of 1.00 denotes flawless consistency in estimation, while an alpha value of 0.00 denotes no uniformity at all.

3.4. Focus Groups

Because focus groups include two or more participants, they might be thought of as non-standard interviews. A focus group's topic is explicitly determined, to keep the conversation

on that subject while capturing participant interaction on camera. In addition, the researcher serves as a moderator to ensure that participants stay within the parameters of the topic under discussion, which are the difficulties associated with the regeneration of sustainable practices. The focus groups also aided in identifying further implementation gaps and opportunities related to sustainability.

To provide this study with a higher validity, the focus group would support the findings from the survey on stakeholders' perceptions on the implementation of sustainable construction practices. In this case, two focus groups with two to eight participants were held. Two comparable focus groups were utilized to gather input on the expert's recommendations for potential cutting-edge sustainable practice tools that may be implemented for sustainability development. When designing or improving the prototypes for the new inventions, the focus group's opinions and suggestions would be taken into consideration.

3.5. Storage of Data

All documentation containing information about the participants, including consent forms, have been kept in a safe place chosen by the research team and no copies of the data have been made, nor are to be made in the future as per the terms of consent acquired from the participants. Documents on paper must be retained for 15 years, according to Gie & Beyers (2014). A lock-up facility that is ideally protected from natural disasters like floods and fires as well as other harmful elements like rats and moths is necessary for long-term storage. In this study, data was stored on shelves instead of the ground at all times as an additional preventive measure against flooding or burst water pipes. For ease of retrieval in the future, data and documents were organized logically, for example, by date, community, or unique identifier. Consent forms and linking lists containing names were kept in a locked filing cabinet apart from one another.

Gie & Beyers (2014) noted that researchers can produce significant new findings by collaborating and connecting more when they share research data. It also facilitates the replication of the findings and opens up new avenues of research for other researchers. Research data sharing is increasingly required and quickly becoming the standard. Publicly

funded research findings ought to be published as Open Access, according to a 2015 NRF Statement on Open Access, which also applies to journals and funding organizations. Additionally, the research's supporting data ought to be made accessible in an authorized Open Access data repository and provided with DOIs for citation needs. There are numerous advantages to data sharing for both individual researchers and the research community. Transparency is encouraged, new discoveries are encouraged, research impact and citation rates are increased, validation and replication are supported, collaboration is enhanced, returns on public investment are increased, and redundant research is decreased. Researchers should think about the ethical and legal ramifications of sharing data when preparing it for distribution, particularly when it comes to human subjects and private subject information (such as the POPI Act), Gie & Beyers (2014) indicated.

3.6. Ethical considerations

The administration of the questionnaire and the interviews both followed the ethical guidelines for informed consent at all times. Before being distributed, the questionnaire respondents were shown the consent form and the letter of identity. In addition to clearly stating the survey's goal, the questionnaire's cover page guaranteed participant privacy. The participants in the telephone interviews were made aware prior to the interview that the audio recording would be used exclusively for research reasons and that an audio device would be used to capture the conversation. Participants in in-person interviews were shown the written statement and the consent letter, which outlined the researcher's position on ethically contentious issues as well as his dedication to maintaining respondents' privacy and security. The participants received guarantees that all information supplied would be treated with the utmost confidentiality and utilised in an unidentifiable manner.

Conclusion

The approach used in this study has been covered in this chapter. The study's methodological framework, including its time horizon, methodologies and procedures, research philosophy, research methodology, research strategy, research decision, and the reasons behind them, were described at the outset. An examination of the research's findings was presented. The ethical principles required in every research work were maintained. How data would be

stored to comply with ethical principles was narrated. The reliability and validity of the research instruments were discussed.

3.7. Analysis of Data

Presenting the analysis of the research findings is the goal of this chapter. The participation of professionals from construction industry projects in this interview is paramount for obtaining in-depth knowledge on the sustainability implementation.

To achieve the research goal, both quantitative and qualitative data were gathered for this study. Quantitative data was gathered to investigate sustainability trends in construction and assess the efficacy of sustainability practices currently employed by firms providing construction services. This was done by investigating the opinions of construction professionals regarding these initiatives. Therefore, the writer used descriptive statistical techniques to analyze the data gathered through surveys. Simplilearn (2023) believed that a collection of techniques known as descriptive statistics is employed to enumerate and characterize a dataset's primary characteristics, including its distribution, variability, and central tendency. These techniques give the data a broad overview and aid in seeing connections and patterns. Examples include central tendency metrics that reveal the typical value in the dataset, like mean, median, and mode. Variability metrics, like standard deviation, variance, and range, characterize how the data are distributed or dispersed. To visually represent the data, descriptive statistics can also make use of graphical techniques like scatter plots, box plots, and histograms. A subfield of statistics known as descriptive statistics is concerned with condensing, organizing, and presenting data understandably and efficiently. Without drawing any conclusions or generalizations to a wider population, it concentrates on summarising and evaluating the key traits and features of a dataset. Descriptive statistics' main objective is to give readers a clear and succinct overview of the data so that analysts and researchers could learn more and recognize trends, patterns, and distributions in the dataset. Measures like central tendency (mean, median, mode), dispersion (range, variance, standard deviation), and distribution shape (Skewness, kurtosis) are commonly included in the summary. In addition, graphical data representation using tables, graphs, and charts was a component of descriptive statistics that could help with information

interpretation and visualization. Histograms, bar charts, pie charts, scatter plots, and box plots are examples of common graphical techniques.

According to the findings, researchers can more effectively communicate and summarise the salient features of a dataset by using descriptive statistics. This helps researchers better understand the data and lays the groundwork for additional statistical analysis or decision-making procedures. The study also reveals that descriptive statistics come in four different flavours: central tendency, variability, standards of relative position, and measures of variability. • Graph-based techniques. The mean, median, and mode are examples of measures of central tendency that characterize the average value in the dataset. The spread or dispersion of the data is represented by measures of variability, which include variance, standard deviation, and range. Percentiles and other measures of relative position are used to describe where a particular value falls within a dataset. Data is displayed using graphic methods such as charts, histograms, and other visual representations.

However, the study discovered that providing an overview of the data and aiding in the identification of patterns and relationships within it is the main goal of descriptive statistics, which aims to efficiently summarise and characterize a dataset's key features. When it comes to identifying outliers, summarising the most important aspects of the data, and guiding the selection of relevant statistical techniques for additional analysis, descriptive statistics offer a helpful place to start. They are frequently employed in a variety of fields, such as business, healthcare, and social sciences. The significance of descriptive statistics lies in their ability to provide meaningful summaries and descriptions of data. It aids in comprehending the primary attributes and traits of a dataset, spotting patterns and trends, and drawing conclusions from the information. The basis for additional analysis, judgment, and dissemination of results is laid by descriptive statistics. Concise and meaningful data summaries and presentations are achieved through the use of descriptive statistics. It is frequently employed in many different domains, including business, economic, social sciences, research, and healthcare. Researchers and analysts can better understand a dataset's central tendency (mean, median, mode), dispersion (range, variance, and standard deviation), and distribution shape by utilizing descriptive statistics. To help with comprehension and visualization, data is also represented graphically, according to (Simplilearn, 2023).

In this study, 200 semi-structured questionnaires were distributed to the stakeholders. Out of the 200 distributed questionnaires, 118 responses were obtained. 82 questionnaires were unreturned. The table below shows the information:

Table 4: Target Population and Response Rate

	Target Population	Returned Rate	Unreturned Rate
	200	118	82
Percentage		59%	41%

To assess the reliability of the research instrument, reliability correlation coefficient was used. The degree of association between two variables, factors, or data sets is evaluated in science and finance using correlation coefficients. The degree to which two variables have a linear relationship is statistically measured by the correlation coefficient. The value of **Correlation Coefficient (r)** ranges from -1.0 to 1.0. A correlation of 1.0 indicates that there is a direct relationship or an absolute positive correlation, while a correlation of -1.0 indicates that there is an absolute negative correlation. The correlation estimate is incorrect if the calculated number is greater than 1.0 or less than -1.0. A correlation quantification error is indicated by a calculated numerical range that is greater than 1.0 or less than -1.0. There is no linear relationship between the movements of variables in a correlation of 0.0. A two-variable complete correlation can be represented by either + 1 or -1. The correlation is positive when one variable rises as the other rises, and negative when one falls as the other rises. A correlation of zero '0' indicates total absence.

a. Calculating the reliability correlation coefficient

Two hundred questionnaires were prepared and distributed to 200 stakeholders in the construction industry. One hundred and eighteen participants responded. Using this figure, the correlation coefficient, r was calculated. This helped in calculating the Cronbach's Alpha (α). With this, the reliability of the research instrument was determined.

Using the number of returned and unreturned questionnaires and the number of questionnaires distributed, the correlation coefficient was calculated using the formula below:

$$\textbf{Reliability Correlation coefficient (r)} = 1 - \frac{0.5x}{3s + y} = 0.78$$

s signifies sample size (returned questionnaires)

x signifies the target population

y signifies unreturned questionnaires

r signifies reliability correlation coefficient

Table 5: Calculation of Correlation Coefficient (*r*)

Target population (n)	Sample size (No. of Returned questionnaires 0 (x)	No. of unreturned questionnaires (y)	Correlation coefficient (r)
200	118	82	0.78

Looking at the correlation coefficient in table 7, the calculated value of 0.78 fell within the range of 0.7 to 1. This signified strong positive relationship between the two variables as indicated in table 8 below.

Table 6: Coefficient correlation values

Correlation coefficient	Correlation strength	Correlation type
0.7 to 1.0	very strong	positive
0.5 to 0.7	strong	positive
0.3 to 0.5	moderate	positive
0 to 0.3	weak	positive
0	none	zero
0 to -0.3	weak	negative
-0.3 to -0.5	moderate	negative
-0.5 to -0.7	strong	negative

-0.7 to -1.0	very strong	negative

Using the calculated reliability correlation coefficient of 0.78, the Cronbach alpha was calculated to determine the degree of internal consistency of the research instruments, as shown below:

Cronbach's Alpha (α) is calculated using:

$$\alpha = \frac{kr}{(1 + (k-1)\, r}$$

Where;

k = number of returned questionnaires.

r = correlation coefficient

$$\alpha = \frac{118 \times 0.78}{1 + (118-1)0.78} = 0.99$$

From the above calculation, the reliability of the research instrument shows a strong positive relationship between the two variables, this means that the research sample size is sufficient to draw a conclusion on the study. If the Cronbach alpha is less than 0.70, the data collection would continue until sufficient information is gathered.

According to Max Hilsdorf (2020), the degree of internal consistency is determined using the table 7 below**:**

Table 7: Tabulation of Cronbach Alpha

No. of Returned Questionnaire (k)	**Reliability Correlation Coefficients (r)**	**Cronbach's Alpha (α)**
118	0.78	0.99

The rate at which alpha is acquired normally specifies the percentage of the reliable variance. For example, a rate of 0.70 indicates that 70% of the variance in the scores is genuine, while 30% is an error variance. It should be mentioned that measurements for single or independent items cannot be accurately obtained using Cronbach's alpha. It produces accurate estimates for summed scales or sub-scales. If individual or independent units are utilized, it is unknown how reliable those units are. This formula, however, should only be used in social and behavioural studies that deal with characters, personalities, perceptions, views, emotions, and interpretations of people's environments.

The Cronbach Alpha is 0.99 with reference to table 7 above. From table 8 below, it is evident that the degree of internal consistency of the research instrument is excellent.

Table 8: Degree of internal consistency

Cronbach's Alpha	**Degree of internal consistency**
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Source: Max Hilsdorf (2020)

b. Calculating the relative importance

This study used the 3-point Likert scale factors below to rate the responses from the participants. On a 3-point Likert scale, respondents are presented with two options at the extremes and a neutral option in the middle. As in the cases of Agree, Disagree, and Neutral, using this kind of scale sparingly is less discriminating in nature, unless a broad spectrum of emotional reactions is anticipated.

Scale	Factor
Agree	3
Neutral	2
Disagree	1

When used in a survey or research setting, the 3-Point Likert Scale is a potent assessment instrument that is used to determine how strongly people feel about things. In a survey, straightforward inquiries that only allow for yes or no responses may be deceptive. And the reason for this is that they don't go into great detail about people's values, aspirations, fears, beliefs, or personalities. For example, political affiliation is not something that can be answered with objectivity when asking yes/no questions. One can have liberal views on education while holding conservative views on religion or abortion rights, for instance. It is advised to measure the degree of agreement or disagreement with multiple questions rather than just one. After that, to obtain a more precise assessment of the beliefs, values, opinions, etc., average or combine the responses. A 3-point Likert scale chart could be useful in this situation. With options ranging from disagree to agree to, the visualisation could give a comprehensive understanding of people's opinions. The 3-point Likert Scale Chart is easy to read and understand.

In this study, each indicator's significance was assessed using a three-point Likert scale. Scale 1 represents disagree, scale 2 represents neutrality, and scale 3 represents agreement. The factors were ranked according to their importance using the relative importance index (RII) method. The RII of each indicator was determined using the formula given below. This was applied in a number of ways to assess the value of indicators.

$$\mathbf{RII} = \frac{\sum \mathbf{W}}{\mathbf{A \times N}} = \frac{\mathbf{3n3 + 2n2 + 1n1}}{\mathbf{3N}}$$

Where;

RII = Relative Importance Index;

W = weight given to each indicator by the respondents which ranges from 1 to 3;

Where 1 = disagree; 2 = neutral; and 3 = agree;

A = Highest weight, which is 3 in this study

N = Total number of participants (50, 37, 31 participants respectively)

n = Number of responses under a particular rating (eg. n3 is total number of respondents rating agree)

Table 9: Profile of participants and related details

ID	Type of participant	No. of respondents	Percentage %
1	Client	50	43
2	Consultant	37	31
3	Contractor	31	26
	Total	**118**	**100**

Table 10: Responses from the stakeholders

A. Contractors' Perspective

1-disagree 2- Neutral 3- Agree

S/No	Sustainability Challenges	1	2	3
1	Inadequate training and education	4	2	25
2	Environmental impact	5	0	26
3	Unaddressed health and safety issues	5	3	23
4	Higher initial costs of green construction	2	4	25
5	Unfamiliarity with green technologies	4	0	27
6	Inappropriate policies and instruments for steering sustainable development	2	0	29
7	Lack of awareness	4	5	22
8	Lack of communication among project team members	3	2	26
9	Demand and the role of clients	8	2	21
10	Difficulty in obtaining the required material resources	5	1	25
11	Lack of sustainable product information	0	3	28
12	Lack of knowledge and skills	4	5	22

13	Climate Change and Its Ramifications	3	1	27
14	Poverty and Social Disparity	0	0	31

B. Consultants' Perspective

1-disagree 2- Neutral 3- Agree

S/No	Sustainability Challenges	1	2	3
1	Inadequate training and education	7	0	30
2	Environmental impact	2	3	32
3	Unaddressed health and safety issues	8	4	25
4	Higher initial costs of green construction	2	0	35
5	Unfamiliarity with green technologies	11	3	23
6	Inappropriate policies and instruments for steering sustainable development	0	10	27
7	Lack of awareness	3	7	27
8	Lack of communication among project team members	7	6	24
9	Demand and the role of clients	3	1	33
10	Difficulty in obtaining the required material resources	1	7	29
11	Lack of sustainable product information	3	1	33
12	Lack of knowledge and skills	4	3	30
13	Climate Change and Its Ramifications	16	13	8
14	Poverty and Social Disparity	1	0	36

C. From Clients' Perspective

1-disagree 2- Neutral 3- Agree

S/No	Sustainability Challenges	1	2	3
1	Inadequate training and education	2	0	48
2	Environmental impact	3	3	44
3	Unaddressed health and safety issues	3	2	45

4	Higher initial costs of green construction	0	1	49
5	Unfamiliarity with green technologies	7	10	33
6	Inappropriate policies and instruments for steering sustainable development	1	9	40
7	Lack of awareness	7	6	37
8	Lack of communication among project team members	2	4	44
9	Demand and the role of clients	9	11	30
10	Difficulty in obtaining the required material resources	3	2	45
11	Lack of sustainable product information	2	0	48
12	Lack of knowledge and skills	0	0	50
13	Climate Change and Its Ramifications	4	13	33
14	Poverty and Social Disparity	0	3	47

For example, from clients' perspective, the relative importance for:

Factor No.1, **RII** = $\frac{3x48 + 2x0 + 1x2}{3x50} = \frac{144+0+2}{150} =$ **0.97**

For the remaining ratings, RII was computed using the same process. To make the analysis easier, the results were totalled and weighted by three using weighted means. This was employed to assess how well-informed the stakeholders are about the sustainability challenges. According to Ekwuno (2022), three Likert scales are categorised by the uniform intervals in order to ascertain the degree of effect by each factor:

Degree of effect

$00.0 \leq$ disagree effect (**DE**) ≤ 50.0

$50.0 \leq$ neutral effect (**NE**) ≤ 60.0

$60.0 \leq$ agree effect (**AE**) ≤ 100

Table 11: Ranking stakeholders' responses based on the weighted RII

S/No	Sustainability factor	Client	Consultant	Contractor	Overall		Degree of effect
		RII	RII	RII	Mean RII	Rank	
1	Inadequate training and education	0.97	0.87	0.89	0.91	**5**	**AE**
2	Environmental impact	0.94	0.93	0.89	0.92	**4**	**AE**
3	Unaddressed health and safety issues	0,94	0.81	0.86	0.87	**7**	**AE**
4	Higher initial costs of green construction	0.99	0.96	0.91	0.95	**2**	**AE**
5	Unfamiliarity with green technologies	0.84	0.77	0.91	0.84	**9**	**AE**
6	Inappropriate policies and instruments for steering sustainable development	0.92	0.90	0.97	0.93	**3**	**AE**
7	Lack of awareness	0.86	0.88	0.86	0.86	**8**	**AE**
8	Lack of communication among project team members	0.94	0.81	0.91	0.88	**6**	**AE**
9	Demand and the role of clients	0.80	0.93	0.80	0.84	**9**	**AE**
10	Difficulty in obtaining the required material resources	0.94	0.91	0.88	0.91	**5**	**AE**
11	Lack of sustainable product information	0.97	0.93	0.96	0.95	**2**	**AE**
12	Lack of knowledge and skills	1.0	0.90	0.86	0.92	**4**	**AE**
13	Climate Change	0.86	0.59	0.92	0.79	**10**	**AE**

	and Its Ramifications						
14	Poverty and Social Disparity	0.98	0.98	1.0	0.98	**1**	**AE**

From the relative importance index above, the contractor believes that the issue of Poverty and Social Disparity is the most important indicator that affects the implementation of sustainable practices in the construction industry. The Demand and the role of clients were ranked least, which is 0.80. From the Consultants' perspective, Poverty and Social Disparity was ranked as the most important indicator affecting implementation of sustainable practices. Climate Change and Its Ramifications was ranked as the least importance. From the client perspective, it is believed that lack of knowledge and skills was the most important indicator that affects the sustainability implementation. While the demand and the role of clients was ranked as the least important indicator. The graphs below show the weighted relative importance for various stakeholders.

Table 12: Client Relative Importance Index (RII)

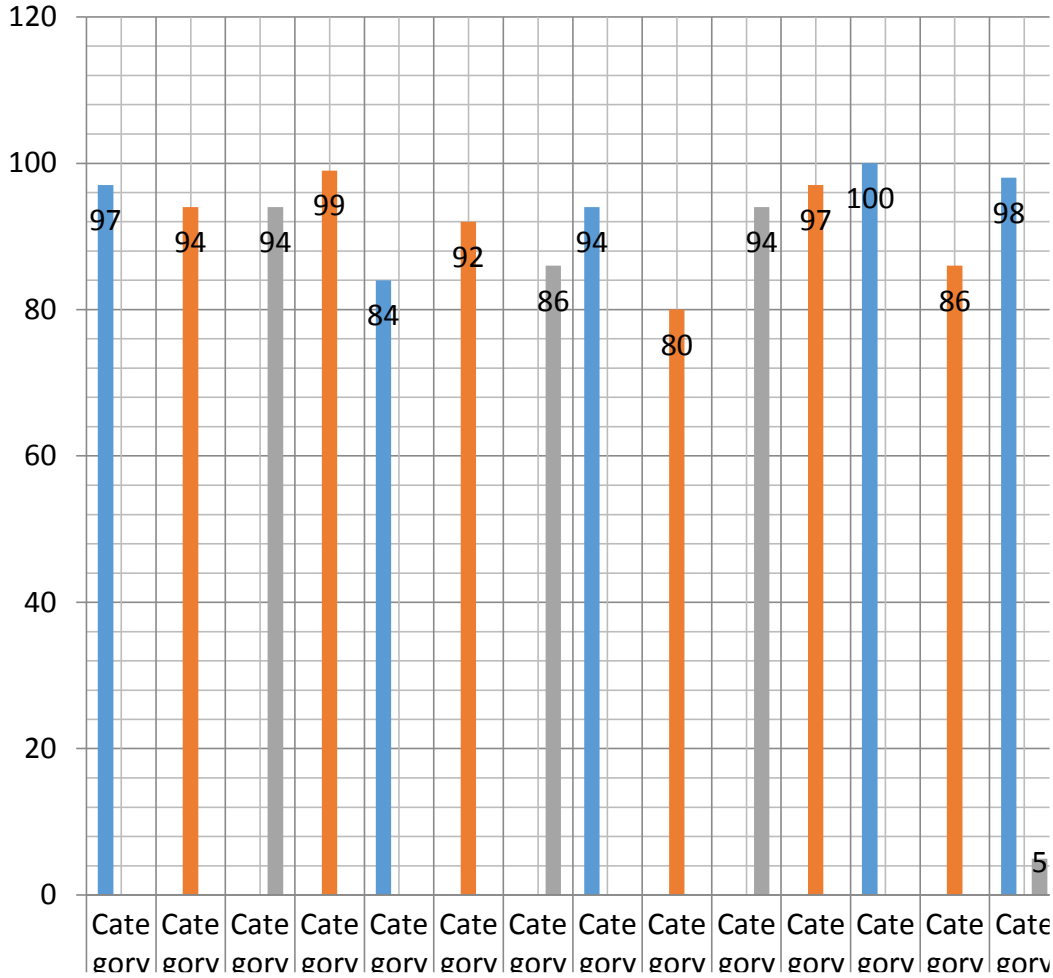


Table 13: Consultant Relative Importance Index (RII)

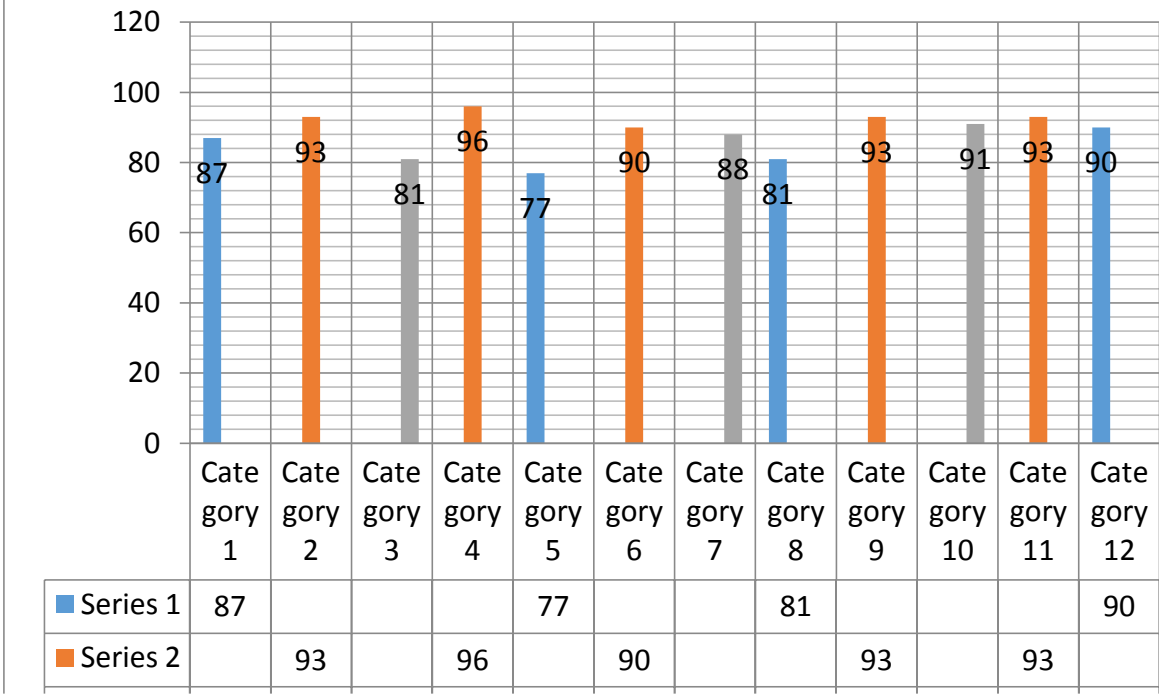
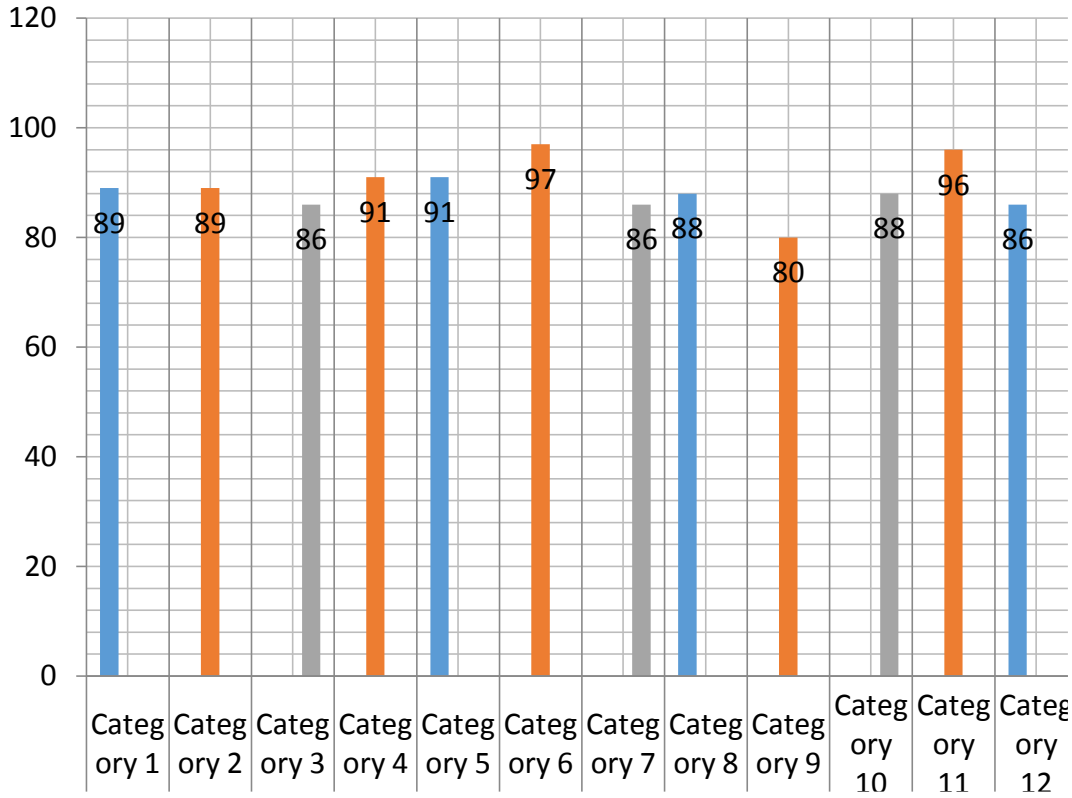


Table14: Contractor Relative Importance Index (RII)



Chapter 4

Contents and Results

At the end of the data collection, 118 stakeholders participated in the survey. The responses from the stakeholders tabulated as follows: 50 from the client perspective, 37 from consultant perspective, and 31 from contractor perspective. The results showed that, for most stakeholders such as client, the most important indicator affecting the implementation of sustainability is lack of knowledge and skills (w = 1.0), followed by Higher initial costs of green construction (w = 0.99) and supported by Poverty and Social Disparity (w = 0.98). Demand and the role of clients, on the other hand, is of low importance compared to the other categories (w = 0.80). See table 11.

From the consultant perspective, the result showed that Poverty and Social Disparity is the most important indicator affecting the use of sustainable practices with w=0.98. This is supported by a higher initial cost of green construction. Climate Change and Its Ramifications, on the other hand, is of low importance compared to the other categories (w = 0.59). See table 11.

From the contractor perspective, the result showed that Poverty and Social Disparity is the most important indicator affecting the use of sustainable practices with w=1.0. This is supported by inappropriate policies and instruments for steering sustainable development with w=0, 98. Demand and the role of clients, on the other hand, is of low importance compared to the other categories (w = 0.80). See table 11.

It is also interesting to note that for all stakeholders from the study, poverty and Social Disparity was placed on a higher value than those other indicators (0.98). The four most important indicators provided by the study are as follows: Higher initial costs of green construction with mean value of w=0.95, Lack of sustainable product information with w=0.95, Inappropriate policies and instruments for steering sustainable development with w=0.93, Environmental impact with w=0.92 and Lack of knowledge and skills with w=0.92.

Conversely, the three least important sustainable weighted indicators according to stakeholders are Climate Change and Its Ramifications (0.79) and unfamiliarity with green technologies (0.84) and demand and the role of clients with w= 0.84.

Moreover, the study's results were compiled and presented in the results section, where they are contextualised with the research question or questions. The study's data were presented objectively, without bias or interpretation, in a logical order. Tables, graphs, and written text were used to report the findings. The study shared only pertinent facts and conclusions that are related to the study's objective. It is very interesting to note that a well-written results section provided the study's findings without making an effort to explain or analyse them.

In order to identify the factors contributing to sustainable issues, the study's face-to-face interviews posed the question, "What are the sustainability challenges in the construction industry?" The following factors were mentioned by the study's participants as drivers: inadequate knowledge and training; environmental effect; unresolved health and safety issues; higher upfront expenses associated with green construction; unfamiliarity with green technologies; Inadequate mechanisms and policies to guide sustainable development Lack of knowledge, poor communication among the project team, client role and demand, Lack of information about sustainable products, difficulty collecting necessary material resources, lack of education and skills, the effects of climate change, poverty and social inequality.

Twelve interviewees in all stated that the primary factor influencing the adoption of sustainability initiatives in their companies is the higher upfront expenses of green construction. Recognizing this as a motivator reveals how businesses see sustainable development. Since sustainability requires a balance between social, environmental, and economic factors, it is critical to consider all relevant factors. A structural imbalance resulting from material selections may require additional work and cost, ultimately leading to an unbalanced building consisting of three pillars. When expensive delays arise, implementing a more complex sustainable design triggers more problems than benefits. In the same way, it's critical to ensure that no structural element is overdesigned and that the project is financially feasible.

Using sustainable energy sources seems to satisfy competitive advantage standards. In order to create a unique capability, it permits cost reduction in addition to resource efficiency, both of which are elements of sustainable development. An interviewee from the construction industry provided the following quote, which explains the steps done to lower energy consumption. The interviewee outlines a successful strategy for cutting energy use that

involves creating natural ventilation systems, which significantly lowers the cost of the ventilation systems that must be installed throughout the structure. This leads to operational effectiveness as well, when an inventive solution to a problem is provided by achieving efficiency in order to obtain a feature needed for a structure at no ongoing expense.

Any organization would be interested in cutting expenses through effective methods, which is why the data places a lot of attention on it. Porter (1985) pointed out that cost reduction is a component of competitive advantage; therefore it makes sense that it is viewed as a desirable result and a catalyst for sustainable development. According to statistics presented by Bansal (2005), environmental challenges can be viewed as opportunities to minimize costs and their negative effects on the environment through efficient use of energy, materials, and trash.

The interviewees mentioned that drawing in clients' attention is one of the main factors influencing their organizations' adoption of sustainability initiatives. A lot of clients have predetermined requirements under which they aim to apply sustainable practices and transfer these to the construction businesses they hire on a contracted basis. This is present in organizations that provide work toward infrastructure and count the government as one of their clients. Construction companies take into consideration the sustainable criteria because the government is a leader in the industry, driving change and "best practice" (Manley, 2006). This may be seen in the following quotation from a construction sector interviewee: "It's very high on our agenda and the majority of people's agenda because they work for government clients.

The government has made sustainability a top priority, as seen by their pledges to meet goals such making all new construction carbon neutral by 2016 (DCLG, 2012). It is obvious that being sustainable would boost the likelihood of gaining them as a client, given the function of government in improving the lives of the populace and appeasing them. This agrees with Roarty (1997) and Rodriguez-Melo and Mansouri (2011), who state that an organization must adjust to appeal to an increasing number of "green" clientele as a result of perception shifts.

Another component of sustainability that is used to draw clients is the potential for financial savings. This results from a custom of cost-based bidding, as noted by Sadreddini (2012),

wherein any savings are able to be transferred to the customers. The following quotation from an interviewee aptly illustrates this: "You can bid less for projects with the assumption that you're saving costs if you can implement sustainable options that are financially viable and make savings if you manage to procure through having just enough material."

When submitting a project bid, the utilization of sustainable measures transfer benefits, as this quotation illustrates. This demonstrates operational effectiveness, or running business more efficiently than competitors and cutting costs in the process. It is crucial for the client to not only purchase the project at the best price, but also to incur lower total expenses over the course of the project's life cycle (Abi-Karam, 2006). Another interviewee emphasized this point by saying, "I suppose there is a cost implication; if a client knows they are going to keep the building for a while and the initial outlay is larger than if it will save them money in the long run, then they are more likely to invest in alternative energy sources etc."

Enhancing the financial system of the clients contributes to the betterment of society, funds non-profit organizations and community development, and satisfies some of the needs of sustainable development. But this also shows a good grasp of the customer and their requirements, as well as an awareness of how the client interacts with the surroundings and the local community. This is consistent with a remark by Rodriguez-Melo and Mansouri (2011), who manage a construction company and emphasize that building a working relationship with the client is the first step towards developing sustainability. During that same interview, the respondent went on to elaborate, saying, "I think we have to demonstrate we have an understanding again; it is not just the planning and building of something; the project starts for the client when the building is completed and it is having an awareness of that."

The 4 people who were interviewed stated that the main force behind the implementation of sustainability measures in their companies was regulation. The laws imposed by the government that specify the direction the industry must take are crucial to this vision. The government has realized that in order to handle major issues like climate change, sustainable development must become a crucial component in collaboration with the global community. The following statement, "Our long-term economic growth relies on protecting and enhancing the environmental resources that underpin it, and paying due regard to social

needs," makes plain how important sustainability is. As a component of dedication to improving wellbeing, this demonstrates how the government has recognized that in order to solve the issues that will affect future generations, transformation is necessary and that sustainability must become a way of life. The following quotation exemplifies this: "This Government wants to mainstream SD so that it is central to the way we make policy, run our buildings, and purchase goods and services, just as leading businesses recognise that sustainability is a core strategic issue and not just a 'nice to have'."

Furthermore, simply adhering to regulations would not provide businesses with a competitive advantage since, as Glass (2010) points out, in the end; businesses are merely responding to mandates rather than actively attempting to innovate. Nevertheless, the quote from the interviewee does not support this. Since voluntary law is optional and need not be followed, it gives the company flexibility to determine the best ways to apply sustainable measures while yet leaving room for error. This allows organizations time to get ready for modifications that may be made to the mandatory laws, such as the incorporation of level 3 energy standards into the construction regulations. The interviewee's comment illustrates how this tendency is expected to continue. Proactive attitude is demonstrated by the fact that experts in the building business expect the development of regulations. The government's proactive strategy, which looks to prevent issues before they develop rather than just reacting when they do, is reflected in the proactive approach employed by organizations (Fehr et al., 2009). As one interviewee put it, law is what drives sustainability, and the introduction of new legislation will determine how sustainable development develops in the future (Seabode, 2012).

Within the industry, sustainability is viewed as innovative (Seabode, 2012). According to data and literature, typical features associated with sustainability include resource efficiency, social impacts, holistic/systemic perspectives, and economic stability. It is vital to adapt in order to survive when rival organizations try to apply these values (Schjeldahl, 2013). The shifts in the industry's concept of sustainable development are also a factor in the mindset that sustainability is becoming more and more necessary for the sector. Required by law, but also evident in the engineering, building, and architecture curricula, there has been an increased focus on sustainability challenges in recent years.

The interviewees mentioned that one of the main factors influencing the implementation of sustainability initiatives in their organizations was management commitment. This driver is associated with socially conscious organizations where management provides assistance for social and environmental issues. Remarks pertaining to this driver are interpreted by organization members as management pledges being fulfilled. Because senior management may influence organizations, their dedication is essential to tackling sustainable concerns (Sarrakh, et al., 2019). Given their positions, managers view the commitments made as the responsible course of action (Renukappa, 2014). Some of these promises may be made out of a sense of managerial duty rather than an explicit desire to support the use of sustainability efforts that offer benefits. Some of the assertions made can be viewed from an altruistic perspective, as demonstrated by the statement that comes before it, which views sustainability as a duty that leads to personal fulfilment. The interviewees mentioned that enhancing their organization's reputation was a major motivator for introducing sustainability efforts. Maintaining a positive reputation is essential to building a company's brand through attention to social, environmental, and financial responsibilities (Renukappa, 2014).

In-person interviews for this study asked participants about the main obstacles their company experiences when putting sustainability efforts into practice. They outline three obstacles that construction companies must overcome to put sustainability ideas into practice. The capabilities of a sustainable construction staff was identified by the study's interviewees as the most prevalent obstacle to the adoption of sustainable techniques. The construction sector experiences persistent materials and labour shortages and is highly dependent on traditional skills.

.

Based on the evidence uncovered thus far, the researcher decided focus group interviews were required in order to provide reasonable explanations for both consensus and disagreements. A thematic analysis was conducted on the interview questions: The economic benefits of sustainability for a greener built environment compared to traditional building systems; The perceptions of stakeholders regarding sustainable construction, sustainable economy, and green economy; The role stakeholder perspectives play in the adoption of innovative sustainable construction; How economic incentives can be leveraged to promote the use of sustainable construction; Extent economic benefits influence the decision-making

process of building owners and property managers when considering the use of innovative materials for a greener built environment; The necessity for corporate sustainability; How regulatory bodies influence the economic benefits; The strategies to be employed to encourage the use of innovative sustainable construction materials; The sustainable challenges facing the construction industry; How sustainable challenges are overcome and designed for a sustainable future; How sustainable practice are championed at work; Discover if there is any need to be rich to be sustainable; How design thinking could help with sustainable development; and How stakeholders compare sustainability and ESG (environment, social, and governance.

The study also discovered that applying solutions for sustainable building (such as repurposing and recycling garbage, or using more environmentally friendly procedures and materials) had numerous advantages. It not only reduces environmental effect, but it also conserves energy during construction, saves money by maximizing resource efficiency and lowering operational expenses, and increases building value. One of the most frequent strategies for construction companies to encourage sustainability is to produce LEED-certified projects. LEED certification verifies that a building meets the requirements for environmental sustainability, taking into account energy, waste, materials, and other considerations. LEED-certified buildings are more valuable since they lower the cost of energy use during the building's lifetime. LEED-certified facilities have lower carbon emissions and promote a better environment for the general population. They can also save owners and builders money by allowing them to use energy incentives and government subsidies to reduce building costs.

Resource conservation is critical to the building industry's sustainability. Modern tools are less power-hungry, so ensure that work teams use the best equipment and maintain it on a regular basis. The use of energy-efficient LEDs in construction lights can significantly reduce draw during night-time projects. Powering down equipment that is not in use will also save valuable fuel and resources. Smart design is also an excellent approach to boost conservation efforts. Rainwater collection and grey water recycling, for example, can conserve water for landscape irrigation, while the installation of dual-flush or low-flow fixtures will significantly cut water use over the course of a building's lifetime.

Making advantage of natural energy is an important aspect of environmentally responsible construction. Renewable energy promotes long-term sustainability while reducing demand. Wind and solar are two major natural energy sources. Wind turbines installed on rooftops generate clean, renewable electricity. They are also low-maintenance and generally simple to manage. Solar panels may convert rooftops into generators that supply a steady source of electricity for houses, businesses, and residences alike. Newer construction solutions, such as photovoltaic windows, make use of sunshine by turning solar power into electricity via glass studded with solar cells. These windows can also regulate building temperatures by automatically altering their transparency, thereby increasing their energy efficiency. Solar panels are found to be useful not just for powering buildings, but also for providing a consistent power source to construction sites by storing solar energy for off-grid use. Solar-powered devices such as generators, light towers, and GPS trackers can assist reduce on-site use. Using electric or hybrid excavators and wheel loaders is significantly more fuel-efficient than traditional equipment, reducing reliance on polluting diesel and other non-renewable fuels. In addition, measures to promote sustainability in construction can be implemented during design, building, and demolition. Building with renewable resources, investing in eco-friendly materials, and/or using environmentally conscious building procedures to decrease pollution are all examples of helpful measures that reduce the environmental impact of construction.

Transitioning construction operations to a digital platform is one guaranteed way to ensure sustainability. The process of manually planning and amending scheduling, paperwork, and plans consumes massive amounts of paper. Furthermore, it can jeopardize the business setting. According to the Construction Business Owner, 70% of enterprises that still utilize paper may suffer catastrophic losses in the case of a flood or fire. In addition to that, 10 liters of water are used to create each piece of A4 paper, and in nations that do not properly harvest and protect their forests, paper production is a significant contributor to deforestation. No more paper waste means less pollution, less water usage, and a halt to deforestation.

Waste is another issue that affects construction sustainability. Waste should be reduced wherever possible. Recyclable and reusable materials, for example, should always be kept apart from waste and objects destined for a landfill. Steel and concrete can be reused in other projects when a building is demolished. Carpets, flooring, and ceiling components could also

be recycled. This can assist cut construction costs, limit waste, and lessen environmental effect. Investing in high-quality tools and equipment lowers the need for replacement and associated waste, as does ensuring that items are cleaned and maintained properly. Heavy equipment should be inspected and certified for compliance on a regular basis to avoid the risk (and cost) of breakage.

The transportation of building materials over great distances contributes to carbon emissions. Buying products from local and regional vendors can shorten the distance between the producer and the construction site, resulting in more sustainable construction. In addition to lowering carbon footprint, sourcing from local suppliers reduces delivery times, resulting in speedier completion and higher productivity. Efficient routing, materials delivery, and site layout optimization aided by tools such as ALICE can also enhance site flow and access, lowering carbon footprint and emissions and boosting construction sustainability.

Conclusion

This outcomes section summarizes and provides the study's findings in connection with the research question(s). The study's results are presented in a logical order, without bias or interpretation. The findings are presented in textual text, figures, tables, and graphs. Only data and findings related to the study's purpose are documented. The findings inform readers about what was learned during the research process.

Chapter 5

Discussion

The environmental factor outweighs other sustainability indices, according to an analysis of existing practices in the field of sustainable construction. This means that in every construction industry project, environmental impact should be considered as priority The implementation of sustainable practices in the construction industry is brought to light by this research, and construction businesses are provided with a tool that enables them to view sustainability as a multifaceted issue that is approached equally from all angles. Additionally, this tool can be used for stakeholder management because it makes it possible to incorporate the opinions and viewpoints of different stakeholders, monitor project performance, plan necessary measures to improve performance, and communicate results easily. Construction companies engaged in the design, construction, operation, and/or maintenance stages are the target audience for the suggested assessment tool. It is determined that the sustainable tools could be applied, meaning that the contractor would be involved from the start and would take on the roles of both designer and constructor. Examining the client's viewpoint and his ability to accept the suggested sustainability instrument makes this problem more difficult. Typically, it shows that the stakeholders should compile a list of sustainability criteria using established guidelines and standards.

The ultimate goal of attaining sustainable development is undoubtedly shared by all involved parties, but the use of the suggested assessment tool as a client requirement is still debatable because there are no clear assessment criteria and there is a dearth of data available for many sustainability-related aspects. Therefore, more research is required to determine whether using the suggested assessment method from the client's perspective is feasible. Since all types of construction projects can benefit from the indications that made up the final list, the suggested framework's applicability is not limited to any one type of project.

Indicators such as “indoor environmental quality” that refer to a specific type of projects were excluded but if needed, could be added very easily in the assessment process. The same applies if any other special project requirements are present as well. The tool can be easily tailored to fit the needs of the project. Lastly, the notion of sustainable development is continuously evolving and governments and other institutions set new regulations to

stimulate progress towards sustainability goals and targets. A construction company that has successfully adopted sustainable principles to report sustainability results could gain a competitive advantage in the market as it will be ready for the future

Chapter 6

Conclusion

This study made an effort to address the main research questions, which were: How the economic benefits of sustainability for a greener built environment are compared to traditional building systems? What are the perceptions of stakeholders regarding sustainable construction, sustainable economy, and green economy? What role do stakeholder perspectives play in the adoption of innovative sustainable construction**?** How can economic incentives be leveraged to promote the use of sustainable construction? To what extent do economic benefits influence the decision-making process of building owners and property managers when considering the use of innovative materials for a greener built environment? Why is corporate sustainability necessary? How do regulatory bodies influence the economic benefits? What are the Strategies to be employed to encourage the use of innovative sustainable construction materials? What are the sustainable challenges facing the construction industry? How these sustainable challenges are overcome and designed for a sustainable future? How does sustainable practice championed at work? Do we need to be rich to be sustainable? How will design thinking help with sustainable development? How do stakeholders compare sustainability and ESG (environment, social, and governance?

The study issued statement was developed by consideration of the kind of artefact that could inspire the adoption of sustainable behaviours for the benefit of end users, specifically. The world has grown increasingly interconnected, and it is clear that urgent action is needed to find sustainable solutions to the severe environmental stress that human activity is causing on the planet. This modification is not only possible, but necessary as well. It is necessary to identify, categorize, and strategically apply all economic and social initiatives, models, and activities that (1) seek to minimize the use of raw materials produced as efficiently as possible using renewable energies and (2) maximize the reuse of waste and prevent sustainability challenges in order to maximize the reuse of waste through its recovery or use as initial raw material. According to Barbosa et al. (2017), the construction industry is not very productive worldwide. According to Duncan, Kingi, and Brunsdon (2018), productivity has grown by 1% year on average over the last 20 years despite being one of the largest in the world economy. By comparison, over the same period, the productivity of the manufacturing

sector increased by 3.6% yearly (Barbosa et al., 2017). For the construction sector to meet the expected demand for new projects, productivity must be significantly increased.

Industry innovation is necessary for productivity growth. The industry needs to shift in order for innovation to meet demand. Without the transformation that allows for innovative new processes and techniques, the industry faces the risk of missing out on the opportunity to capitalize on this demand. Numerous studies have made clear how much reform is required in the construction sector. These evaluations offer recommendations for modifications to particular areas of practice along the value chain of the industry, with an emphasis on increasing productivity to meet the growing demand for construction. The construction industry should use novel materials to boost efficiency. The increasing and wasteful use of resources has resulted in poverty, pollution, poor health, loss of biodiversity, and climate change. These problems are related to one another and frequently make one another worse. It makes sense that the planet's natural resources are finite because humans have depended on them for millennia to thrive. Scarcity can lead to price hikes, problems, and conflicts. It can also leads to increased efforts to find new resources, often with unexpected or odd results. The scale of the environmental and socioeconomic concerns is enormous. It takes a fundamental shift in mindset to accomplish sustainable growth. This require dematerialization, cradle-to-cradle production techniques, and a move from products to services in addition to just optimizing resource use.

Building energy retrofit as a catalyst for sustainability cannot be integrated into socio-technical ideas without an empirical framework, which prevents the construction sector from creating project value and advancing continuously. Consequently, the main study questions generated an interest in locating the real artefact for applying sustainable principles and their advantages in the building industry. This key query prompts the formulation of the research problem statement, which claims that implementing sustainability in buildings continues to be a significant obstacle that requires attention. Sub-questions were developed based on the research questions that were stated above.

According to the results of the study, the following actions should be the focus of current best practices for implementing sustainable practices: a thorough energy study to ascertain tenant

behaviour; a building analysis or internal evaluation to determine the state and functional ability of the structure; completing a cost-benefit analysis to determine the most appropriate finance model for the project; a technical analysis to benchmark appraise and determine the best alternative for applying sustainable practices; An implementation plan for the project, wherein the planning of the project should be done in terms of understanding occupant behavior involved in the energy efficiency measures and assigning appropriate timelines to the stakeholders; monitoring and verification, wherein this involves informing building users about the energy efficiency measures of the building and ensuring that operation and maintenance procedures are checked for further improvement. The best practices in the construction sector are those that have been described above.

The study's findings suggest that the following factors are essential for the successful adoption of sustainable practices in the construction industry: sufficient training and education; environmental impact; addressed health and safety issues; minimal initial costs of green construction; familiarity with green technologies; use of appropriate policies and instruments for steering sustainable development; creation of sustainability awareness; full client participation in sustainable discussions; availability of the necessary material resources; availability of sustainable product information; consideration of work teams' knowledge and skills; consideration of climate change and its implications in initial project discussion; and correct technical The study came to the conclusion that attempts to adopt sustainable practices might not be successful if all the variables are not taken into account. According to the report, communication and consultation problems ranked highest on the list. The participants reported, among other things, that there is a lack of social data incorporated into projects, that stakeholder activities are inadequate and insufficient, that there is a lack of agreement among stakeholders, and that doing things piecemeal is challenging. This is quickly followed by a lack of cooperation and teamwork, which is centred on experts acting at random and a lack of stakeholder activities to gain buy-in for the project, resulting in haphazard work. Project flexibility and adaptation provide yet another significant difficulty. The study also found that one major obstacle is a lack of technical expertise. Other obstacles are equally important and include the capital cost of these kinds of investments, the unpredictability of the payback period, and the restricted availability of financing.

The study's findings suggest that enhancing communication and consultation with all parties involved, particularly those residing in the impacted buildings can significantly tackle the issue of inadequate communication and consultation. According to the participants, information sessions are necessary to gather and share activity details and provide what is genuinely required. Enhancement of collaboration and coordination among stakeholders is another aspect that warrants attention. The study also reveals how crucial it is to provide contractors with training. It's also essential to provide grants and low-interest loans for sustainability initiatives as incentives. It's also necessary to raise awareness among homeowners and tenants through focused education so they can see the energy and money-saving possibilities of these activities. It is necessary to properly design for sustainability to ensure that it does not interfere with or negatively impact building operations. Another restriction is the dearth of knowledge and the scarcity of items for sustainable deployment. In order to solve this issue, eco-friendly products ought to be purchased from reliable suppliers following extensive market analysis. In order to prevent, or at least minimize, the fragmentation of sustainable operations, a well-thought-out plan for managing the various parties participating in the sustainability development is also essential for streamlining implementation.

The research reveals that since no two projects are the identical, specialists working on them should gain a great deal from being adaptable and implementing knowledge gained via administrative innovation and continual development. According to the problem statement presented in the research's introduction, a clear reporting mechanism is lacking, which leads to a poor integration of sustainability into construction methods. There appears to be no widespread agreement on a suitable set of indicators, based on the vast number of performance indicators that have been produced in previous years.

this study advances the scientific field of construction sustainability by addressing a gap in the literature and proposing an assessment method that enables a comprehensive evaluation of sustainability performance within the construction content, taking equal weight to all dimensions and indicators, Furthermore, the conceptual framework is developed with simplicity—rather than complexity—as the primary guiding principle to support businesses

in adopting a new results-reporting mindset. The suggested framework eschews the use of sophisticated tools and methodologies in favour of a commitment by businesses and individuals to continuously assess and improve sustainability performance.

6.1. Limitations

One noteworthy phenomenon in the construction business is their unwillingness to participate in research requests. As such, gathering research data is frequently a challenging process. This was demonstrated by the use of mixed-methods research methodology in this study. The primary restriction on this study is thus that in order to obtain information, the researcher had to go through stringent procedures with study-relevant organizations. Some respondents' registered email addresses, phone numbers, and physical addresses did not match the information in the database. Although, they had been promised anonymity and confidentiality, a few respondents flatly refused to take part in the study. When the researcher arrived at the contractor's location, some of the scheduled and confirmed interviews were cancelled. This scenario contradicts the researcher's intended findings. Still, the data collected was sufficient to complete the assignment.

Although the inquiry was limited to one project, the prospect of looking into further real-life initiatives was considered. Other projects could not be looked at due to the short time constraint for this research and the construction companies' reluctance to assist the author with the case study application. The interviewees were a sustainability consultant for the consortium of contractors and engineering firms carrying out the project. Furthermore, as seen from the client's point of view, the contractor was required to disclose results solely for the environmental impact, suggesting that there is no legal obligation on the part of businesses to give results. Nonetheless, it is unsafe to extrapolate the results of this study to all construction projects, such as energy or building projects, since laws and contemporary practices may vary greatly from the enterprises under study. The initial plan for the qualitative interviews was to interview a range of sustainability specialists from different departments in order to get a variety of perspectives. There hasn't been enough discussion of the subjectivity problem in the assessment process.

Recommendations

Recommendations for Decision makers: The construction business has entered a new age. Industry has been introduced, which refers to using technologies in the building industry to increase quality, save time and money, and promote construction sustainability. There are numerous technologies linked with industry. Virtual reality, augmented reality, and BIM are just a handful of the technologies available. According to the research findings, most projects have implemented a variety of technologies, the most common of which is BIM. Other technologies, such as Virtual Reality, are being used to aid organizations by allowing them to demonstrate the eventual end product to the public and improve decision-making within project teams. Most of the technologies included in Industry are still in their early stages, and it is recommended that more research be conducted on these technologies in the future. This will allow the construction industry to understand the benefits that can be gained from these technologies, and with the industry being known for resisting change, demonstrating these benefits can be the beginning of the construction industry embracing change. It has been determined that sustainability challenges are complicated, dynamic, and multifaceted. The majority of sustainability programs are naturally collaborative because they aim to benefit the community and future generations.

To address some of the world's sustainability issues, prominent leaders and decision makers must collaborate with other stakeholders in order to have a good societal influence. Traditional product innovation is insufficient in today's business environment to ensure an organisation's long-term competitive advantage. To accomplish this, firms must prioritize innovative means of value creation. Business model innovation enables the delivery of fresh value propositions to customers by transforming the value creation, delivery, and capture processes. However, there are circumstances in which business model innovation fails, primarily when businesses fail to satisfy the process's set goals and align functional areas of the company to provide the desired output.

The countries that are leading the implementation of BIM globally, such as the United States and the United Kingdom, have set targets that drive their application in the construction industry; however, there is still a need to disseminate knowledge about what green Building Information Modelling is and the benefits associated with its use in infrastructure projects. It

is not worthwhile to design outstanding programs and laws if there are no skilled professionals in the area. Green BIM is a method that engages all project stakeholders, including contractors and clients. If any of them are not trained to follow the desired flow, the project will not be successful or yield the promised results. As a result, it would be advantageous for all governments to give financial and economic support for the education of various building professions.

Furthermore, in order to achieve this, more government laws and incentives must be created in the country to ensure a rise in the organizations' encouragement of sustainable ways. Smart technology offers huge potential to automate construction firms' systems and processes, provide managers with better data/information, and assist them in accomplishing more tasks and activities while remaining visible to their communities. As a result, there is a need to incorporate more smart technology projects in the construction industry. It is recommended that rules be implemented to encourage large organisations to incorporate smart devices into their projects, as well as to finance its implementation in small and micro businesses. To keep the environment safe and pollution-free, the government typically applies a number of environmental rules that limit the project's scope. This has a further impact on the project's functioning, ultimately lowering its performance. One of the most significant difficulties facing the construction industry is a lack of leadership skills required for the successful implementation of environmental sustainability projects. As a result, there is an urgent need to create and provide tailored leadership training programs that address, improve, and measure the effectiveness of leadership skills in driving change toward sustainability. This is because organizations that embrace sustainability programs benefit from increased reputation, higher employee engagement, lower operational costs, and stronger relationships with key stakeholders. A clear and strong brand should improve public impression of the quality of services provided by a construction firm, resulting in increased trust, loyalty, and a reduction in perceived risk. As a result of the increased demand for the planet's limited resources, several organizations have sought new and more sustainable ways to operate. As a result, companies must ensure that their operations have a good influence on both the environment and society. Furthermore, organizations are increasingly seeing economic prospects from the implementation of business models that address sustainability issues. Some construction organizations are still in the process of implementing smart technology projects to address sustainability concerns.

The influence of leadership, sustainability-related policies, structures, reward systems, training programs, and performance reporting are all important variables in the successful implementation of sustainability projects. It argues that more clarification is required on how construction organizations must change to meet the sustainability issue, as well as how these changes may be implemented. As a result, cross-sector collaboration is required to record and exchange best and worst practices in the implementation of smart technology. Construction organizations that have implemented sustainable mobile applications have seen positive results such as a precise, clear, and scalable reporting system, improved timely tactical decision-making, more efficient management of hazardous materials and waste, well-organized KPI management, and overall improved control of electricity, water, fossil fuels, waste, transport, and supply chain. However, it is critical to choose an application that meets the needs of the organization. When addressing an appropriate application, organizations must examine the various variables offered in the software selection framework. This can ensure that the correct software is chosen, which will improve the organization's sustainability initiatives. Encourage the development of more ecologically friendly construction processes that can be applied to a variety of projects, using green BIM technologies. Because buildings are entities sought and used by people, it is critical that the community understands the benefits of implementing green BIM and sustainable policies, which may be required for their adoption. As a result, the dissemination of green BIM methodology and sustainable construction through programs, communication and advertising campaigns assists governments in meeting their objectives and contributes to the strengthening of the construction industry.

The construction business is in an evolutionary phase; the next generation of construction workers is expected to improve quality, productivity, and efficiency. Technologies are transforming industrial production, and these digital technologies are being employed in manufacturing. If completely accepted by the construction sector, they can lead to improved efficiency and relationships between all disciplines in an organization. The paucity of knowledge and expertise related to sustainability initiatives is, and will continue to be, a significant barrier for some construction companies. As a result, training programs focused on the management of sustainability-related information will assist leaders, managers, and change agents in better understanding how to develop and implement various sustainability-related strategies for competitive advantage. The study states that digital technology adoption

in the construction industry is still in its early stages; nevertheless, technologies like as BIM and Mobile Applications are increasingly widely employed in Western countries.

Other technologies, such as VR, Drones, and Robotics, are still in their early stages; drones and VR are being tested on some projects, but they are not widely used yet. As a result, business and construction education curriculum must incorporate digital technology into their courses. Organisations that innovate their business models are better able to create positive social and environmental change by redefining their purpose, developing mutually beneficial relationships with stakeholders, or increasingly interacting with the market as they seek legitimacy throughout the institutions and markets in which they operate. A sustainable company plan should ideally contribute to long-term development while maintaining a competitive advantage by providing customers with more value.

Conflict of Interest

The author declares that the research was carried out without any business or financial relationships that could be seen as a potential conflict of interest.

Appendices

Appendix 1: Sustainable Challenges

Voluntary Research Questionnaires				
For the Degree of Doctor of Philosophy in Construction Management at Selinus University of Sciences and Literature, Italy				
Question: What are the sustainable challenges facing the construction industry?				
Select from the Likert Scale of 1 – 3				
1- disagree 2-Neutral 3-Agree				
S/No	**Sustainability Challenges**	**1**	**2**	**3**
1	Inadequate training and education			
2	Environmental impact			
3	Unaddressed health and safety issues			
4	Higher initial costs of green construction			
5	Unfamiliarity with green technologies 4			
6	Inappropriate policies and instruments for steering sustainable development			
7	Lack of awareness			
8	Lack of communication among project team members			
9	Demand and the role of clients			
10	Difficulty in obtaining the required material resources			
11	Lack of sustainable product information			
12	Climate Change and Its Ramifications			
13	Poverty and Social Disparity			
	Are you a: ☐ Consultant ☐ Contractor ☐ Client			
	Write down any other views:			

Appendix 2: Motivation for Sustainability Implementation

Voluntary Research Questionnaires				
For the Degree of Doctor of Philosophy in Construction Management at Selinus University of Sciences and Literature, Italy				
Question: How are sustainable challenges overcome and designed for a sustainable future?				
Select from the Likert Scale of 1 – 3				
1- disagree 2-Neutral 3-Agree				
S/No	**Sustainability Challenges**	**1**	**2**	**3**
1	Provide adequate training and education			
2	Resolve Environmental impact			
3	address health and safety issues			

4	Provide adequate finance for green construction			
5	Be familiar with green technologies			
6	Ensure appropriate policies and instruments for steering sustainable development			
7	Create sustainability implementation awareness			
8	Ensure effective communication among project team members			
9	Clients to provide all necessary information at the early stage of a project			
10	Availability of the required material resources			
11	Provide adequate sustainable product information			
12	Climate Change to be incorporated in the early design work			
13	Ensure equality in subsidizing sustainability development			
	Are you a: ☐ Consultant ☐ Contractor ☐ Client			
	Write down any other views:			

Bibliographies

Abbie H. (2021). The Challenges of Sustainable Construction

Abdulrahman D. Alsulaili & Marwa F. Al-Matrouk & Rabab A. Al-Baghli & Amal F. Al-Enezi, 2020. "Environmental and economic benefits of applying green building concepts in Kuwait," Environment, Development and Sustainability: A Multidisciplinary Approach to the Theory and Practice of Sustainable Development, Springer, vol. 22(4), pages 3371-3387, April.Handle: RePEc:spr:endesu:v:22:y:2020:i:4:d:10.1007_s10668-019-00352-1 DOI: 10.1007/s10668-019-00352-1

Adeniyi[a]* Shogo Musbau, Sarajul Fikri Mohamed[b] , Kolawole Olayinka Rasak[c] (2020). Socio-Economic Benefits of Using Green Materials for the Construction of Low-Cost Buildings in Nigeria. American Scientific Research Journal for Engineering, Technology, and Sciences (ASRJETS)

Aghion P., Bechtold S., Cassar L., and Herz H. (2014). The Causal Effects of Competition on Innovation: Experimental Evidence Working paper.

Agyekum, Kofi & Adinyira, Emmanuel & Baiden, B.K. & Ampratwum, Godslove & Duah, Daniel. (2019). Barriers to the adoption of green certification of buildings: A thematic analysis of verbatim comments from built environment professionals. Journal of Engineering, Design and Technology. 17. 10.1108/JEDT-01-2019-0028.

Aigbavboa, Clinton & Ohiomah, Ifije & Zwane, Thulisile. (2017). Sustainable Construction Practices: "A Lazy View" of Construction Professionals in the South Africa Construction Industry. Energy Procedia. 105. 3003-3010. 10.1016/j.egypro.2017.03.743.

Akadiri, Peter & Chinyio, Ezekiel. (2012). Design of A Sustainable Building: A Conceptual Framework for Implementing Sustainability in the Building Sector. Buildings. 2. 126-152. 10.3390/buildings2020126.

Aktas, Bahacan & Ozorhon, Beliz. (2015). Green Building Certification Process of Existing Buildings in Developing Countries: Cases from Turkey. Journal of Management in Engineering. 31. 05015002. 10.1061/(ASCE)ME.1943-5479.0000358.

Aladag, Hande & Demirdöğen, Gökhan & Işik, Zeynep. (2016). Building Information Modeling (BIM) Use in Turkish Construction Industry. Procedia Engineering. 161. 174-179. 10.1016/j.proeng.2016.08.520.

Ala-Juusela, Mia & Short, Michael & Shvadron, Uzi. (2014). Tools to support sustainable entrepreneurship in energy positive Neighbourhoods. Entrepreneurship and Sustainability issues. 2. 49-59. 10.9770/jesi.2014.2.2(1).

Al-Hajj, Assem & Horner, Malcolm. (1998). Modelling the running costs of buildings. Construction Management & Economics. 16. 459-470. 10.1080/014461998372231.

Alotaibi, Ali & Fotwe, Francis & Price, A.. (2019). Critical Barriers to Social Responsibility Implementation within Mega-Construction Projects: The Case of the Kingdom of Saudi Arabia. Sustainability. 11. 10.3390/su11061755.

Alsanad, S.A. (2015) Awareness, Drivers, Actions, and Barriers of Sustainable Construction in Kuwait. Procedia Engineering 118, 969 – 983. https://doi.org/10.1016/j.proeng.2015.08.538

Alves A, Patiño Gómez J, Vojinovic Z, Sánchez A, Weesakul S. Combining Co-Benefits and Stakeholders Perceptions into Green Infrastructure Selection for Flood Risk Reduction. Environments. 2018; 5(2):29. https://doi.org/10.3390/environments5020029

Ametepey[1], S. O. and Ansah[2], S. K. (2014). Impacts of Construction Activities on the Environment: The case of Ghana. Journal of Construction Project Management and Innovation Vol. 4 (S1): 934-948.

Ametepey, Simon & Aigbavboa, Clinton & Ansah, Samuel. (2015). Barriers to Successful Implementation of Sustainable Construction in the Ghanaian Construction Industry. Procedia Manufacturing. 3. 1682-1689. 10.1016/j.promfg.2015.07.988.

Anders Bjørn et al 2020. Environ. Res. Lett. 15 083001DOI 10.1088/1748-9326/ab89d7

Asmi, Ade & Azis, Abdul & Memon, Aftab & Abdul Rahman, Ismail & Nagapan, Sasitharan & Imran Latif, Qadir Bux. (2012). Challenges faced By Construction Industry in Accomplishing Sustainablity Goals. 10.1109/ISBEIA.2012.6422966.

Ashford, N. A., & Hall, R. P. (2011). The Importance of Regulation - Induced Innovation for Sustainable Development. Sustainability, 3(1), 270292. https://doi.org/10.3390/su3010270

Ayandibu, A. O., & Houghton, J. (2017). The Role of Small and Medium Scale Enterprise in Local Economic Development (LED). Journal of Business and Retail Management Research, 11, 133-139. http://jbrmr.com/

Azapagic A. (2003). Systems Approach to Corporate Sustainability: A General Management Framework, Process Safety and Environmental Protection, Volume 81, Issue 5, 2003, Pages 303-316, https://doi.org/10.1205/095758203770224342

Balkyte, Audrone & Tvaronaviciene, Manuela. (2011). THE ROLE OF MIGRATION FOR SUSTAINABLE DEVELOPING ECONOMY: LITHUANIA IN THE EU CONTEXT. Journal of Security and Sustainability Issues. 1. 133-145. 10.9770/jssi.2011.1.2(6).

Baloi, D (2003) Sustainable construction: challenges and opportunities. In: Greenwood, D J (Ed.), 19th Annual ARCOM Conference, 3-5 September 2003, University of Brighton. Association of Researchers in Construction Management, Vol. 1, 289-97.

Bamigboye G O et al (2019), Innovation in Construction Materials-A Review. IOP Conference Series: Materials Science and Engineering. 640 012070 doi:10.1088/1757-899X/640/1/012070

Barbosa, F., Woetzel, J., & Mischke, J. (2017). Reinventing construction: A route of higher productivity. McKinsey Global Institute.

Bassioni, H. & Price, A. & Hassan, Tarek. (2004). Performance Measurement in Construction. Journal of Management in Engineering - J MANAGE ENG. 20. 10.1061/(ASCE)0742-597X(2004)20:2(42).

Bell E. & Bryman A. (2007). The Ethics of Management Research: An Exploratory Content Analysis. British Journal of Management. 18.63-77.10.1111/j.1467-8551.2006.00487.x.

Berawi, M. A., Miraj, P., Windrayani, R., & Berawi, A. R. B. (2019). Stakeholders' perspectives on green building rating: A case study in Indonesia. *Heliyon*, *5*(3), Article e01328. https://doi.org/10.1016/j.heliyon.2019.e01328

Biswas, Chiranjit & Chakraborti, Abanishwar & Majumder, Swanirbhar. (2023). The Integrated Management of Renewable Energy Systems. 10.52305/SLPI5681.

Blaikie, N. 1993: Approaches to social enquiry. Oxford: Polity Press. Progress in Human Geography, 18(2), 257-258. https://doi.org/10.1177/030913259401800215

Blayse, A. & Manley, K. (2004). Key influences on construction innovation. Construction Innovation, 4(3), 143–154.

Bohari Asmah Alia Mohamad, Martin Skitmore, Bo Xia, Melissa Teo, Natasha Khalil,(2020). Key stakeholder values in encouraging green orientation of construction procurement, Journal of Cleaner Production,
Volume 270, 2020, https://doi.org/10.1016/j.jclepro.2020.122246.

Bosetti, Valentina & Carraro, Carlo & Massetti, Emanuele & Tavoni, Massimo. (2007). Optimal Energy Investment and R&D Strategies to Stabilise Greenhouse Gas Atmospheric Concentrations. Fondazione Eni Enrico Mattei, Working Papers.

Bradshaw, S. (2015). Engendering Development and Disasters. Disasters, 39, S54-S75. https://doi.org/10.1111/disa.12111

Brandli Luciana, Lucas Veiga Ávila, Walter Leal Filho, Colin J. Macgregor, Petra Molthan-Hill, Pinar Gökçin Özuyar, Rodrigo Martins Moreira, (2017). Barriers to innovation and sustainability at universities around the world, Journal of Cleaner Production,
Volume 164, Pages 1268-1278, https://doi.org/10.1016/j.jclepro.2017.07.025.

Brian L. (2015). Five Benefits of Embracing Sustainability and Green Manufacturing

Brucker N, Moro AM, Charão MF, Durgante J, Freitas F, Baierle M, Nascimento S, Gauer B, Bulcão RP, Bubols GB, Ferrari PD, Thiesen FV, Gioda A, Duarte MM, de Castro I, Saldiva PH, Garcia SC. Biomarkers of occupational exposure to air pollution, inflammation and oxidative damage in taxi drivers. Sci Total Environ. 2013 Oct 1;463-464:884-93. doi: 10.1016/j.scitotenv.2013.06.098. Epub 2013 Jul 19. PMID: 23872245.

Bryman, A. and Bell, E. (2003) Business Research Methods. Oxford University Press, Oxford. Caiado, Rodrigo & Nascimento, Daniel Luiz & Quelhas, Osvaldo & Tortorella, Guilherme & Rangel, Luis. (2018). Towards sustainability through Green, Lean and Six

Sigma integration at service industry: review and framework. Technological and Economic Development of Economy. 24. 1659-1678. 10.3846/tede.2018.3119.

Cameron C. (2020). The Future is Now – Science for Achieving Sustainable Development

Castleton, Holly & Stovin, Virginia & Beck, S.B.M. & Davison, John. (2010). Green roofs; Building energy savings and the potential for retrofit. Energy and Buildings. 42. 1582-1591. 10.1016/j.enbuild.2010.05.004.

Chan, Albert Ping Chuen, Amos Darko, and Ernest Effah Ameyaw. 2017. "Strategies for Promoting Green Building Technologies Adoption in the Construction Industry—An International Study" *Sustainability* 9, no. 6: 969. https://doi.org/10.3390/su9060969

Chegut, A., Eichholtz, P., & Kok, N. (2014). Supply, Demand and the Value of Green Buildings. *Urban Studies*, *51*(1), 22–43. http://www.jstor.org/stable/26145695

Chikwuado Emenike Kingsley 2020. The Impact of Sustainable Management of Commercial Properties on Investment Returns in Orlu, Imo State. International Journal of Progressive Sciences and Technologies (IJPSAT). http://ijpsat.ijsht-journals.org Vol. 19 No. 2, pp. 185-192

Chiranjit P. and Antonio S. (2023). How can you overcome challenges to lead a sustainable organization?

Chong TT, Bonnelle V, Husain M. Quantifying motivation with effort-based decision-making paradigms in health and disease. Prog Brain Res. 2016;229:71-100. doi: 10.1016/bs.pbr.2016.05.002. Epub 2016 Jul 7. PMID: 27926453.

Christensen, Pernille & Robinson, Spenser & Simons, Robert (2018). The influence of energy considerations on decision making by institutional real estate owners in the US. Renewable and Sustainable Energy Reviews. 94. 275-284. 10.1016/j.rser.2018.05.061.

Clarke, V., & Braun, V. (2013). Successful qualitative research: A practical guide for beginners. Successful qualitative research, 1-400.

Coady D., Flamini V., and Sears L. (2015). The Unequal Benefits of Fuel Subsidies Revisited: Evidence for Developing Countries

Collis, J. and Hussey, R. (2009) Business Research: A Practical Guide for Undergraduate and Postgraduate Students. 3rd Edition, Palgrave Macmillan, Basingstoke.

Collins M., Tim B., Karen B., Bayne A. D., and Sigrid S. (2003). Building Green in New Zealand: Wood - a sustainable construction choice

Copiello S., Bonifaci P. and Stanghellini S. (2015). The Methodological Framework of Feasibility Study to Support Strategic Planning, Procedia - Social and Behavioral Sciences, Volume 223, 2016, Pages 45-50, https://doi.org/10.1016/j.sbspro.2016.05.287.

Cordano, M., & Frieze, I. H. (2000). Pollution reduction preferences of US environmental managers: Applying Ajzen's theory of planned behavior. Academy of Management journal, 43(4), 627-641.

Costanza, R. (2003). A vision of the future of science: reintegrating the study of humans and the rest of nature. doi:10.1016/S0016-3287(02)00105-2

D'Amato D., Droste N., Winkler K.J., Toppinen A. (2019). Thinking green, circular or bio: Eliciting researchers' perspectives on a sustainable economy with Q method, Journal of Cleaner Production, Volume 230, pages 460-476, https://doi.org/10.1016/j.jclepro.2019.05.099.

Damoah, I.S. and Kumi, D. (2018) Causes of Government Construction Projects Failure in an Emerging Economy: Evidence from Ghana. International Journal of Managing Projects in Business, 11, 558-582. https://doi.org/10.1108/IJMPB-04-2017-0042

Darko, Amos & Zhang, Chenzhuo & Chan, Albert. (2017). Drivers for Green Building: A Review of Empirical Studies. Habitat International. 60. 10.1016/j.habitatint.2016.12.007.

David P. 1996 Modern Environmentalism: An Introduction, viii, 376 pp., figures, tables, glossary. London and New York: Routledge. Reviewed by Adrian Peace. Journal of Political Ecology. 4. 52. 10.2458/v4i1.21390.

Dempsey, Nicola & Bramley, Glen & Power, Sinead & Brown, Caroline. (2011). The Social Dimension of Sustainable Development: Defining Urban Social Sustainability. Sustainable Development. 19. 289 - 300. 10.1002/sd.417.

Deng Y., Wu J., Huang J. Morck, R. K., Yeung, B. Y. (2014). Incentives and Outcomes: China's Environmental Policy. Capitalism and Society, Vol. 9, No. 1, Article 2, 2014, Available at SSRN: https://ssrn.com/abstract=2399048

Deniyi, S. M., Mohamed, S. F., & Rasak, K. O. (2020). Socio-economic benefits of using green materials for the construction of low-cost buildings in Nigeria. Ame. Scient. J. Engr. Tech. Sci, 67(1), 99-108.

Denzin, N. K., & Lincoln, Y. S. (2003). The landscape of qualitative research theories and issues. Thousand Oaks, CA: Sage.

De Wit, M. (2016). Another look at Economic Approaches to Environmental Management and Policy with Reference to Developments in South Africa. South African Journal of Economic and Management Sciences, 19(5), 690-701.

Díaz-López C, Navarro-Galera A, Zamorano M, Buendía-Carrillo D. (2021). Identifying Public Policies to Promote Sustainable Building: A Proposal for Governmental Drivers Based on Stakeholder Perceptions. Sustainability, 13(14):7701. https://doi.org/10.3390/su13147701

Dickie, I. and Howard, N. (2000) Assessing environmental impacts of construction. Industry consensus, BREEAM and UK Ecopoints. Digest 446.

Ding, G.K.C. (2008) Sustainable Construction—The Role of Environmental Assessment Tools. Journal of Environmental Management, 86, 451-464. https://doi.org/10.1016/j.jenvman.2006.12.025

Dosumu, O. . and Aigbavboa, C. . (2021) "Drivers and effects of sustainable construction in the South African construction industry", *Acta Structilia*, 28(2), pp. 78–107. doi: 10.18820/24150487/as28i2.4.

Doug J. (2023). Navigating the Growing Risks: 6 Sustainable Building Design Challenges in the Construction Sector

Duncan, A., Kingi, V. M., & Brunsdon, N. (2018). Adopting new ways in the Building and Construction Industry. BRANZ.

Du Plessis, Chrisna. (2005). Action for sustainability: Preparing an African plan for sustainable construction, Building Research and Information, 33. 10.1080/09613210500218974.

Dr David Tann (2021). Sustainability - The greatest challenge of the construction industry

Easterly, William & Levine, Ross. (2003). Tropics, germs and crops: How endowments influence economic growth. 50. 41-47.

Edum-Fotwe, F. & Price, A.. (2009). A social ontology for appraising sustainability of construction projects and developments. International Journal of Project Management. 27. 313-322. 10.1016/j.ijproman.2008.04.003.

Ekhaese E. N. and Ndimako O. O. (2023). Eco-friendly construction materials and health benefits in the design of an all-inclusive health resorts, Nigeria, Sec. Construction Management, Volume 9 - 2023 | https://doi.org/10.3389/fbuil.2023.1011759

Paul Ekins, & Zenghelis, Dimitri. (2021). The costs and benefits of environmental sustainability. Sustainability Science. 16. 10.1007/s11625-021-00910-5.

Ekwuno A. O. and Dr. Nel H. (2022). Analyzing the Project Delay Causes in the South African Construction Industry.

Ekwuno A. O. (2022). The Value of Effective Communication in the Construction Industry.

Enayat A., Szetey, Katrina & Moallemi, & Ashton, Emma & Butcher, Martin & Sprunt, Beth & Bryan, Brett. (2021). Participatory planning for local sustainability guided by the Sustainable Development Goals. Ecology and Society. 26. 10.5751/ES-12566-260316.

Erika loučanová1, Hubert Paluš[1]*, Klára Báliková[2], Michal Dzian[1], Nikola Slašťanová[1], Jaroslav Šálka[2] (2020). Stakeholders' Perceptions of the Innovation Trends in the Slovak Forestry and Forest-Based Sectors

Eriksson, P., & Kovalainen, A. (2008). *Qualitative methods in business research*. SAGE Publications Ltd, https://doi.org/10.4135/9780857028044

Ewa Zender – Świercz, (2020), Improvement of indoor air quality by way of using decentralised ventilation, Journal of Building Engineering, Volume 32, 101663, https://doi.org/10.1016/j.jobe.2020.101663.

Ezeokoli, F. O., Ehimioboh, C. O., Okoye, P. U., & Ekekezie, C. U. (2023). Construction stakeholders' perception on sustainable housing development in Anambra State, Nigeria. European Journal of Sustainable Development Research, 7(1), em0202. https://doi.org/10.29333/ejosdr/12537

Farmer, M. (2016). The Farmer review of the UK construction labour model. Modernise or die: Time to decide the industry's future. London, UK: Construction Leadership Council. Available at: http: /www.constructionleadershipcouncil.co.uk/wpcontent/ uploads/2016/10/Farmer-Review.pdf

Fatoki, Olawale & Mankgele, Khutso Pitso (2020). NETWORKING AND SUSTAINABLE PERFORMANCE OF SMALL AND MEDIUM ENTERPRISES IN SOUTH AFRICA. Academy of Entrepreneurship Journal. 26. 1-6.

Fellows, R. and Liu, A. (2008) Research Methods for Construction. 3rd Edition, Blackwell Publishing Ltd., Hoboken, NJ.

Freeman, R. E., Harrison, J. S., Wicks, A. C., Parmar, B. L., & De Colle, S. (2010). Stakeholder theory: The state of the art.

Frigione M, Aguiar JLB. 2020 Innovative Materials for Construction. Materials (Basel), 13(23):5448. doi: 10.3390/ma13235448. PMID: 33276426; PMCID: PMC7730497.

Geekiyanage, Devindi & Ramachandra, Thanuja. (2018). A model for estimating cooling energy demand at early design stage of condominiums in Sri Lanka. Journal of Building Engineering. 17. 10.1016/j.jobe.2018.01.011.

Gibbs, G.R. (2007) Thematic Coding and Categorizing, Analyzing Qualitative Data. SAGE Publications Ltd., London. http://dx.doi.org/10.4135/9781849208574

Goh, C. S., Rowlinson, S., & Yip, B. (2013). *An Exploration of Stakeholders' Perceptions of Sustainable Construction*. Paper presented at International Conference in Sustainable Development in Building and Environment 2023, Chongqing, China.

Goh, C. S., Su, F., & Rowlinson, S. (2023). Exploring Economic Impacts of Sustainable Construction Projects on Stakeholders: The Role of Integrated Project Delivery. Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 15(3), Article 04523026. https://doi.org/10.1061/JLADAH.LADR-963

Gunduz, Murat & Yahya, Ahmad. (2018). Analysis of project success factors in construction industry. Technological and Economic Development of Economy. 24. 67-80. 10.3846/20294913.2015.1074129.

Hak, Tomas & Janoušková, Svatava & Moldan, Bedřich. (2015). Sustainable Development Goals: A need for relevant indicators. Ecological Indicators. 60. 565-573. 10.1016/j.ecolind.2015.08.003.

Hamma-adama, Mansur & Salman, Huda & Kouider, Tahar. (2018). Diffusion of Innovations: The Status of Building Information Modelling Uptake in Nigeria. Journal of Scientific Research and Reports. 17. 1-12. 10.9734/JSRR/2017/38711.

Hatch J. A. (2002). Doing Qualitative Research in Education Settings

Hatch, M. J., & Cunliffe, A. L. (2006). Organization Theory: Modern, Symbolic, and Postmodern Perspectives (2nd ed.). New York: Oxford University Press.

Hayles, Carolyn & Kooloos, T. (2008). The challenges and opportunities for sustainable building practices. 16-18.

Henry, Alexandre & Frascaria-Lacoste, Nathalie. (2012). Comparing green structures using life cycle assessment: A potential risk for urban biodiversity homogenization?. The International Journal of Life Cycle Assessment. 17. 949-950. 10.1007/s11367-012-0462-3.

Heintz, J. & Wamelink, J. (2015). Overcoming Barriers to Innovation in the Building Industry. BOSS Magazine, 52, 25–31.

Hidalgo , C. A., klinger, B. Barabási, A.-L.and Hausmann R. (2007). The Product Space Conditions the Development of Nations, Vol 317, Issue 5837, pp. 482-487. DOI: 10.1126/science.1144581

Hill, R. C., & Bowen, P. A. (1997). Sustainable construction: principles and a framework for attainment. Construction Management and Economics, 15(3), 223–239. https://doi.org/10.1080/014461997372971

Hills, Gerald & Hultman, Claes & Miles, Morgan. (2008). The Evolution and Development of Entrepreneurial Marketing. Journal of Small Business Management. 46. 99 - 112. 10.1111/j.1540-627X.2007.00234.x.

Hoa, Tran & Limskul, Kitti. (2013). Economic impact of CO2 emissions on Thailand's growth and climate change mitigation policy: A modelling analysis. Economic Modelling. 33. 651–658. 10.1016/j.econmod.2013.04.019.

Hörisch, J., Freeman, R. E., & Schaltegger, S. (2014). Applying Stakeholder Theory in Sustainability Management: Links, Similarities, Dissimilarities, and a Conceptual Framework. Organization & Environment, 27(4), 328-346. https://doi.org/10.1177/1086026614535786

Horta, Isabel & Camanho, A.s & Johnes, Jill & Johnes, Geraint. (2013). Performance trends in the construction industry worldwide: An overview of the turn of the century. Journal of Productivity Analysis. 39. 89-99. 10.1007/s11123-012-0276-0.

Hwang, Bon-Gang & J, Tan. (2012). Sustainable Project Management for Green Construction: Challenges, Impact, and Solutions.

IEA (2019), Innovation Gaps, IEA, Paris https://www.iea.org/reports/innovation-gaps, License: CC BY 4.0

Ikram Muhammad and Thanh Tiep Le (2022). Do sustainability innovation and firm competitiveness help improve firm performance? Evidence from the SME sector in Vietnam, Sustainable Production and Consumption, Volume 29, Pages 588-599, https://doi.org/10.1016/j.spc.2021.11.008.

Israel[2] G. D. (1992). Determining Sample Size

Jackson C. (2021). The Methods and Benefits of Sustainable Construction

Joshua Ayarkwa a , De-Graft Joe Opoku b , Prince Antwi-Afari c,* , and Rita Yi Man Li d (2022). Sustainable building processes' challenges and strategies: The relative important index approach. Cleaner Engineering and Technology 7 (2022) 100455

Kádárová Jaroslava, Durkáčová Michaela, Teplická Katarína, Kádár Gabriel, (2015) The Proposal of an Innovative Integrated BSC – DEA Model, Procedia Economics and Finance, Volume 23, Pages 1503-1508, https://doi.org/10.1016/S2212-5671(15)00375-5.

Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi- structured interview guide. Journal of advanced nursing, 72(12), 2954-2965.

Kats, G., Alevantis, L., Berman, A., Mills, E. and Perlman, J. (2003). The Costs and Financial Benefits of Green Buildings. A Report to California's Sustainable Building Task Force.

Khataybeha A. M., Subbarinia M. , and Shurmana S.(2010). Education for Sustainable Development, an International Perspective. Academic research paper on "Educational sciences" doi:10.1016/j.sbspro.2010.07.149

Khoshbakht, Maryam & Gou, Zhonghua & Dupre, Karine. (2017). Cost-benefit Prediction of Green Buildings: SWOT Analysis of Research Methods and Recent Applications. Procedia Engineering. 180. 167-178. 10.1016/j.proeng.2017.04.176.

Khoshbakht, Maryam & Gou, Zhonghua & Dupre, Karine. (2016). Cost-Benefit Prediction of Green Buildings: SWOT Analysis of Research Methods and Recent Applications.

Kibert C. J. (2016). Sustainable Construction: Green Building Design and Delivery

Kim, Y., & Peterson, R. A. (2017). A Meta-Analysis of Online Trust Relationships in E-Commerce. Journal of Interactive Marketing, 38, 44-54. https://doi.org/10.1016/j.intmar.2017.01.001

Ku-Mahamud, Ku & Omar, Mazni & Abu Bakar, Nur Azzah & Muraina, Ishola. (2019). Awareness, Trust, and Adoption of Blockchain Technology and Cryptocurrency among Blockchain Communities in Malaysia. International Journal on Advanced Science, Engineering and Information Technology. 9. 1217. 10.18517/ijaseit.9.4.6280.

Krugman P. (1991)Increasing Returns and Economic Geography, Journal of Political Economy, 1991, vol. 99, no. 3.

Kibwami, N orcid.org/0000-0002-3639-3382 and Tutesigensi, A orcid.org/0000-0002-5514-1594 (2016) Enhancing sustainable construction in the building sector in Uganda. Habitat International, 57. pp. 64-73. ISSN 0197-3975 https://doi.org/10.1016/j.habitatint.2016.06.011

Kivimaa Paula, Wouter Boon, Sampsa Hyysalo, Laurens Klerkx (2019). Towards a typology of intermediaries in sustainability transitions: A systematic review and a research agenda, Research Policy, Volume 48, Issue 4, pages 1062-1075

Knut B and Philipp H. (2023). Stakeholder perceptions of the role of standards for addressing the sustainable development goals, Sustainable Production and Consumption, Volume 37, Pages 180-190, https://doi.org/10.1016/j.spc.2023.02.016.

Koutsogiannis A. (2018). Ten Benefits of Sustainable Construction

Kubba, S. (2010). Green Construction Project Management and Cost Oversight. Green Construction Project Management and Cost Oversight. 10.1016/C2009-0-20060-2.

Ku-Mahamud, Ku & Omar, Mazni & Abu Bakar, Nur Azzah & Muraina, Ishola. (2019). Awareness, Trust, and Adoption of Blockchain Technology and Cryptocurrency among Blockchain Communities in Malaysia. International Journal on Advanced Science, Engineering and Information Technology. 9. 1217. 10.18517/ijaseit.9.4.6280.

Larsson, S., Jansson, M. & Boholm, (2019). Å. Expert stakeholders' perception of nanotechnology: risk, benefit, knowledge, and regulation. J Nanopart Res 21, 57 https://doi.org/10.1007/s11051-019-4498-1

Lash J. & Wellington F. (2007). Competitive Advantage on a Warming Planet

Leo-Olagbaye, F.; Odeyinka, H.; and Rathnasiri, P. (2023). Stakeholders' Roles in the Delivery of Sustainable Housing Projects in Lagos State, Nigeria. Sustainability 2023, 15, 11709. https://doi.org/10.3390/su151511709

Lewis S (2023). 4 Challenges facing the construction industry

Liberman, Leonardo & Hooper, Terrena & Hutchings, Kate. (2010). Toward a Model of Understanding Strategic Decision-Making in Micro-Firms: Exploring the Australian Information Technology Sector. Journal of Small Business Management. 48. 10.1111/j.1540-627X.2009.00287.x.

Limskul, Kitti &.Hoa, Tran (2013). Economic impact of CO2 emissions on Thailand's growth and climate change mitigation policy: A modelling analysis. Economic Modelling. 33. 651–658. 10.1016/j.econmod.2013.04.019.

Loosemore Martin (2006). Risk Management in Projects

Lucon, O., Ürge-Vorsatz, D., Ahmed, A.Z., Akbari, H., Bertoldi, P., Cabeza, L.F., Eyre, N., Gadgil, A., et al. (2014). Chapter 9 - Buildings. In: Climate Change 2014: Mitigation of Climate Change. IPCC Working Group III Contribution to AR5. Cambridge University Press.

Lupp, G., Huang, J. J., Oen, A., Del Sepia, N., Martinelli, A., Lucchesi, M., Wulff Knutsen, T., Olsen, M., Fjøsne, T. F., Balaguer, E., Arauzo, I., Solheim, A., Kalsnes, B., & Pauleit, S. (2021). Stakeholder Perceptions of Nature-Based Solutions and Their Collaborative Co-Design and Implementation Processes in Rural Mountain Areas—A Case Study From PHUSICOS. Frontiers in Environmental Science, 9. https://doi.org/10.3389/fenvs.2021.678446

Lindhard, Søren & Larsen, Jesper. (2016). Identifying the key process factors affecting project performance. Engineering Construction & Architectural Management. 23. 657 - 673. 10.1108/ECAM-08-2015-0123.

Littig, Beate & Griessler, Erich. (2005). Social sustainability: A catchword between political pragmatism and social theory. International Journal of Sustainable Development. 8. 10.1504/IJSD.2005.007375.

Liu, T.; Chen, L.; Yang, M.; Sandanayake, M.; Miao, P.; Shi, Y.; & Yap, P.-S. (2022). Sustainability Considerations of Green Buildings: A Detailed Overview on Current Advancements and Future Considerations. Sustainability 14, 14393. https://doi.org/10.3390/su142114393

Lowe, D., & Proverbs, D. (Ed.) (2003). Economic Challenge of Sustainable Construction. In D. Proverbs (Ed.), Proceedings of the RICS Construction and Building Research Conference, School of Engineering and the Built Environment, (pp. 113-126). RICS Foundation.

Liu, Zhi-Jiang, Paula Pypłacz, Marina Ermakova, and Pavel Konev. 2020. "Sustainable Construction as a Competitive Advantage" *Sustainability* 12, no. 15: 5946, https://doi.org/10.3390/su12155946

Lucon, Oswaldo & Ürge-Vorsatz, Diana & Akbari, Hashem & Bertoldi, Paolo & Cabeza, Luisa F. & Eyre, Nick & Gadgil, Ashok & Harvey, Danny & Jiang, Yi & Liphoto, Enoch & Mirasgedis, Sebastian & Murakami, Shuzo & Parikh, Jyoti & Pyke, Christopher & Vilariño, Maria. (2014). Climate Change 2014: Mitigation. Chapter 9: Buildings. Report by the Intergovernmental Panel on Climate Change.

Leo-Olagbaye, Feyisetan, Henry Odeyinka, and Pavithra Rathnasiri. 2023. "Stakeholders' Roles in the Delivery of Sustainable Housing Projects in Lagos State, Nigeria" Sustainability 15, no. 15: 11709. https://doi.org/10.3390/su151511709

Machaka M. and Windapo A. (2018). Conventional and sustainable buildings: a comparative benefit and cost analysis. (2018). *journal of construction project management and innovation*, *8*(1), 1696-1710. https://doi.org/10.36615/jcpmi.v8i1.151

Mashwama, nokulunga & thwala, wellington & aigbavboa, clinton & hamma-adama, mansur. (2020). a stakeholder perspective on the implementation of sustainable construction practices. 10.14455/isec.res.2020.7(1)sus-04.

Mashwama, N., Thwala, W. & Aigbavboa, C. (2019). Sustainable Construction Practices Challenges-A Stakeholders Perspective. 10.3311/CCC2019-102

Mashwama[1] M., Thwala[1] D, Aigvbavboa[1] C., & Hamma-Adama[2] M. (2020). A Stakeholder Perspective on the Implementation of Sustainable Construction Practices. Proceedings of International Structural Engineering and Construction Emerging Technologies and Sustainability Principles

Matell, M. S., & Jacoby, J. (1971). Is there an optimal number of alternatives for Likert scale items? I. Reliability and validity. *Educational and Psychological Measurement, 31*(3), 657–674. https://doi.org/10.1177/001316447103100307

Matheny A. (2023). Leveraging Economic Incentives in Site Selection

Matsuyama, K. (1991) Increasing Returns, Industrialization, and Indeterminacy of Equilibrium, *The Quarterly Journal of Economics*, Volume 106, Issue 2, May 1991, Pages 617–650, https://doi.org/10.2307/2937949

Mavi, R. K., & Standing, C. (2018). Critical success factors of sustainable project management in construction: A fuzzy DEMATEL-ANP approach. Journal of Cleaner Production, 194, 751-765

Mealy, P and Teytelboym, A, (2017). Economic Complexity and the Green Econom. https://ssrn.com/abstract=3111644 or http://dx.doi.org/10.2139/ssrn.3111644

Medineckiene Seržantė, Milena & Zavadskas, Edmundas & Bjork, Folke & Turskis, Zenonas. (2014). Multi-criteria decision-making system for sustainable building assessment/certification. Archives of Civil and Mechanical Engineering. 15. 10.1016/j.acme.2014.09.001.

Meena, C.S.; Kumar, A.; Jain, S.; Rehman, A.U.; Mishra, S.; Sharma, N.K.; Bajaj, M.; Shafiq, M.; Eldin, E.T. (2022). Innovation in Green Building Sector for Sustainable Future. Energies, 15, 6631.https://doi.org/10.3390/en15186631

Meus, J., De Vits, S., S'heeren, N., Delarue, E., & Proost, S. (2021). Renewable electricity support in perfect markets: Economic incentives under diverse subsidy instruments. *Energy Economics*, *94*, 105066.

Miraj, Perdana & Berawi, Mohammed & Windrayani, Retno & Berawi, Abdur. (2019). Stakeholders' perspectives on green building rating: A case study in Indonesia. Heliyon. 5. e01328. 10.1016/j.heliyon.2019.e01328.

Mirniazmandan, Seyedehaida & Rahimianzarif, Ehsan. (2017). Biomimicry an Approach toward Sustainability of High-Rise Buildings. Journal of Architectural Engineering Technology. 06. 10.4172/2168-9717.1000203.

Montiel I, Cuervo-Cazurra A, Park J, Antolín-López R, Husted BW. Implementing the United Nations' Sustainable Development Goals in international business. J Int Bus Stud. 2021;52(5):999-1030. doi: 10.1057/s41267-021-00445-y. Epub 2021 May 25. PMID: 34054154; PMCID: PMC8144281.

Nahman, A. (2009). The economic benefits of moving up the waste management hierarchy in South Africa: The value of resources lost through landfilling

Nanda, S. (2005). The Essential Guide to Doing Research. 2004. *Social Change*, *35*(4), 167-169. https://doi.org/10.1177/004908570503500413

Nduka, David & Sotunbo, Adegboyega. (2014). Stakeholders perception on the awareness of green building rating systems and accruable benefits in construction projects in nigeria.

Nelms, Cheryl & Russell, Alan & Lence, Barbara. (2011). Assessing the performance of sustainable technologies for building projects. Canadian Journal of Civil Engineering. 32. 114-128. 10.1139/l04-102.

Newcombe, Robert. (2003). From client to project stakeholders: A stakeholder mapping approach. Construction Management & Economics. 21. 841-848. 10.1080/0144619032000072137.

Nwokoro, Immaculata & Onukwube, Henry. (2011). Sustainable or Green Construction in Lagos, Nigeria: Principles, Attributes and Framework. Journal of Sustainable Development. 4. 10.5539/jsd.v4n4p166.

OECD (2010). Regulatory Policy and the Road to Sustainable Growth

Ogunmakinde, O.E., Sher, W.D., and Maund K. **(2016).** Specific challenges and local opportunities

Oguntona, Olusegun & Akinradewo, Opeoluwa & Ramorwalo, Dineo & Aigbavboa, Clinton & Thwala, Wellington. (2019). Benefits and Drivers of Implementing Green Building Projects in South Africa. Journal of Physics: Conference Series. 1378. 032038. 10.1088/1742-6596/1378/3/032038.

Oğuz A, Oyedele T, Mani M. P., Labh S., Shepherd, A. Fotis S. K, Saul H., and Lupo, R. (2024). What are the most significant environmental challenges facing the construction industry today?

Oluwunmi, Adedamola & Oladayo, Popoola & Role, B & Afolabi, T. (2019). Benefits and Barriers to the Implementation of Green Building Standards in Universities: What are Students' Views?. IOP Conference Series: Materials Science and Engineering. 640. 012031. 10.1088/1757-899X/640/1/012031.

Opoku, De-Graft & Ayarkwa, Joshua & Agyekum, Kofi. (2019). Barriers to environmental sustainability of construction projects. Smart and Sustainable Built Environment. 8. 10.1108/SASBE-08-2018-0040.

Ostrom, E. 2000. "Collective Action and the Evolution of Social Norms." *Journal of Economic Perspectives*, 14 (3): 137-158**.**DOI: 10.1257/jep.14.3.137

Outram, K. (2024). Innovating to ensure sustainability in the construction industry

Oyewole, M. O. Komolafe M. O. & Gbadegesin J. T. (2023) Understanding stakeholders' opinion and willingness on the adoption of sustainable residential property features in a developing property market, International Journal of Construction Management, 23:2, 358-370, DOI: 10.1080/15623599.2021.1874676

Park, Jongchul & Lee, Hanjoon & Kim, Chankon. (2014). Corporate social responsibilities, consumer trust and corporate reputation: South Korean consumers' perspectives. Journal of Business Research. 67. 295–302. 10.1016/j.jbusres.2013.05.016.

Peace, A. (1997). David Pepper 1996 Modern Environmentalism: An Introduction, viii, 376 pp., figures, tables, glossary. London and New York: Routledge. Reviewed by Adrian Peace. Journal of Political Ecology. 4. 52. 10.2458/v4i1

Philipp Heß and Knut Blind (2023). Stakeholder perceptions of the role of standards for addressing the sustainable development goals. Sustainable Production and Consumption. 37. 10.1016/j.spc.2023.02.016.

Podsiadło P, Zender-Świercz E, Strapazzon G, Kosiński S, Telejko M, Darocha T, Brugger H. Efficacy of warming systems in mountain rescue: an experimental manikin study. Int J Biometeorol. 2020 Dec;64(12):2161-2169. doi: 10.1007/s00484-020-02008-6. Epub 2020 Sep 1. PMID: 32869111; PMCID: PMC7658064.

Popp, D (2004), ENTICE: endogenous technological change in the DICE model of global warming, Journal of Environmental Economics and Management, **48**, (1), 742-768

Porter, Michael E., and Claas van der Linde. 1995. "Toward a New Conception of the Environment-Competitiveness Relationship." *Journal of Economic Perspectives*, 9 (4): 97-118**.**DOI: 10.1257/jep.9.4.97

Porter, M.E. (2000) Location, Competition and Economic Development: Local Clusters in a Global Economy. Economic Development Quarterly, 14, 15-34. http://dx.doi.org/10.1177/089124240001400105

Porumboiu Diana 2021 Social Innovation - the What, Why and How

Posner R. A, (1997). "Social Norms and the Law: An Economic Approach," 87 American Economic Review 365

Prof. Dr. Jacqueline Cramer (2023). Challenges in implementing sustainable construction

Ramirez Villegas, Ricardo & Eriksson, Ola & Olofsson, Thomas. (2019). Life Cycle Assessment of Building Renovation Measures–Trade-off between Building Materials and Energy. Energies. 12. 344. 10.3390/en12030344.

Reddy, Sanjay G., Strategies for Attaining the Sustainable Development Goals (February 16, 2016). https://ssrn.com/abstract=3208250 or http://dx.doi.org/10.2139/ssrn.3208250

Ries, R.B., Gokhan M. M., Nuri M. N., and Kim L. (2006). The economic benefits of green buildings: a comprehensive case study.
http://www.entrepreneur.com/tradejournals/article/print/152374315.html

Robert L. (2017). Top 4 Challenges Facing the Construction Industry.

Robson, C. (2002). Real World Research: A Resource for Social Scientists and Practitioner-Researchers (2nd ed.). Oxford: Blackwell Publishers Ltd.

Rogelj, J., den Elzen, M., Höhne, N. et al. Paris Agreement climate proposals need a boost to keep warming well below 2 °C.
Nature 534, 631–639 (2016). https://doi.org/10.1038/nature18307

Rogers, E.M. (2010). Diffusion of Innovations. 4th Edition,

Rowe, S & Davis LLP (2011). The Financial Benefits of Green Building Green Building.

Sabone, Mogale & Addo-Tenkorang, Richard. (2016). Adoption of performance measurement systems: a study of Botswana's construction industry.

Sadineni Suresh B., Srikanth Madala, Robert F. Boehm, (2011). Passive building energy savings: A review of building envelope components, Renewable and Sustainable Energy Reviews, Volume 15, Issue 8, pages 3617-2631.
https://doi.org/10.1016/j.rser.2011.07.014.

Saunders, M., Lewis, P. and Thornhill, A. (2009) Research Methods for Business Students. Pearson, New York.

Sayer, A. (1994). The Aetiology of Urban Change. *Sociology*, *28*(2), 559-566. https://doi.org/10.1177/0038038594028002012

Schöggl, Josef-Peter & Stumpf, Lukas & Baumgartner, Rupert. (2020). The narrative of sustainability and circular economy - A longitudinal review of two decades of research. Resources, Conservation and Recycling. 163. 105073. 10.1016/j.resconrec.2020.105073.

Schröpfer, Veronika & Tah, Joseph & Kurul, Esra. (2016). Mapping the knowledge flow in sustainable construction project teams using social network analysis. Engineering Construction & Architectural Management. 24. 10.1108/ECAM-08-2015-0124.

Schwenk Charles R. (1995). Strategic decision making, Journal of Management,
Volume 21, Issue 3, 1995, Pages 471-493, https://doi.org/10.1016/0149-2063(95)90016-0.

Shabrin, Nushrat & Kashem, Saad. (2017). A comprehensive cost benefit analysis of green building.

Shad, Kashif & Lai, Fong-Woon & Fatt, Chuah & Klemeš, Jiri & Bokhari, Awais. (2018). Integrating Sustainability Reporting into Enterprise Risk Management and its Relationship with Business Performance: A Conceptual Framework. Journal of Cleaner Production. 208. 10.1016/j.jclepro.2018.10.120.

Shahzad, Mohsin & Qu, Ying & Ur Rehman, Saif & Zafar, Abaid. (2022). Adoption of Green Innovation Technology to Accelerate Sustainable Development among Manufacturing Industry. Journal of Innovation & Knowledge. 7. 10.1016/j.jik.2022.100231.

Sharma, S. (2002). Research in corporate sustainability: What really Matters. Research in Corporate Sustainability: The Evolving Theory and Practice of Organizations in the Natural Environment, 1, 29

Shepherd Neil Gareth & Rudd John Maynard (2013), The Influence of Context on the Strategic Decision-Making Process: A Review of the Literature. https://doi.org/10.1111/ijmr.12023

Sibiya, Mandisa & Aigbavboa, Clinton & Thwala, Wellington. (2015). Construction Projects' Key Performance Indicators: A Case of the South African Construction Industry. 954-960. 10.1061/9780784479377.111.

Simpeh[1] E. K. and Smallwood[2] J. J. (2018). Analysis of the Benefits of Green Building in South Africa.

Sinha, Arijit & Gupta, Rakesh & Kutnar, Andreja. (2013). Sustainable Development and Green Buildings. Drvna Industrija. 64. 45-53. 10.5552/drind.2013.1205.

Skordoulis, Michalis & Arabatzis, G. & Chalikias, Miltiadis & Ntanos, Stamatios & Galatsidas, Spyros & Drosos, Dimitris. (2020). Managers' Perceptions on Environmental Sustainability.

Smit A. M. and Du Toit F (2015). Investigating the Financial Benefits of Green Buildings. Environmental Economics, 6(3), 61-71

Srinivas, N. (2009). Against NGOs?: A Critical Perspective on Nongovernmental Action. Non-profit and Voluntary Sector Quarterly, 38(4), 614-626. https://doi.org/10.1177/0899764009334308

Stevenson, Fionn & Morgan, Chris (2005). Design for Deconstruction. Building For a Future.. 14. 1-4.

Tafazzoli, M. (2017). Becoming Greener in Construction: Overcoming Challenges and Developing Strategies, DO - 10.1061/9780784481202.001

Tan, Y., Shen, L., and Yao, H. (2011). Sustainable construction practice and contractors' competitiveness: A preliminary study Habitat International 35(2), pp. 225-230.

Tauriainen, Matti & Marttinen, Pasi & Dave, Bhargav & Koskela, Lauri. (2016). The Effects of BIM and Lean Construction on Design Management Practices. Procedia Engineering. 164. 567-574. 10.1016/j.proeng.2016.11.659.

Tayeh, Bassam & Al-Hallaq, Khalid & Alaloul, Wesam & Kuhail, Ahmed. (2018). Factors Affecting the Success of Construction Projects in Gaza Strip. The Open Civil Engineering Journal. 12. 301-315. 10.2174/1874149501812010301.

Thatcher A, Milner K. Changes in productivity, psychological wellbeing and physical wellbeing from working in a 'green' building. Work. 2014;49(3):381-93. doi: 10.3233/WOR-141876. PMID: 24858521.

Thomas, Howard & McGee, John & Wilson, David. (2010). Strategy: Analysis and Practice.

Thomas, Cibu & Ye, Frank & Irfanoglu, Mustafa & Modi, Pooja & Saleem, Kadharbatcha & Leopold, David & Pierpaoli, Carlo. (2014). Thomas et al., 2014 Supplement.

Thorpe R. and Easterby-Smith J. (2015). Management and Business Research

Trochim, W. (2000) The Research Method Knowledge Base. 2nd Edition, Atomic Dog Publishing, Cincinnati.

UNDP(2017), Design Thinking. A guide for prototyping and testing solutions for the sustainable and development goals.

Van Asselt, H., Kulovesi, K. Seizing the opportunity: tackling fossil fuel subsidies under the UNFCCC. Int Environ Agreements **17**, 357–370 (2017). https://doi.org/10.1007/s10784-017-9357-x

Venkatesh V. & Davis F. (2000). A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. Management Science. 46. 186-204. 10.1287/mnsc.46.2.186.11926.

Vazquez E., Rola S., Martins D., Freitas M., & Rosa L. P. (2011). Sustainability In Civil Construction Applied In The Construction Site Phase, Volume 144, Pages 12, Page Range 265 – 27, DOI: 10.2495/ECO110241

Vickers, J. & Fisher, B. (2018). The carbon footprint of New Zealand's built environment: Hotspot or not? Wellington: thinkstep-anz. https://www.thinkstep-anz.com/resrc/ reports/the-carbon-footprint-of-new-zealands-built-environment/;

Wamsler, C. (2020). Education for sustainability: Fostering a more conscious society and transformation towards sustainability. International Journal of Sustainability in Higher Education, 21(1), 112-130.

Waidyasekara, K., & Fernando, W.W. (2012). Benefits of adopting green concept for construction of buildings in Sri Lanka.

Webb, R. (2005). Leading Teaching and Learning in the Primary School from "Educative Leadership" to "Pedagogical Leadership". Educational Management Administration & Leadership, 33, 69-91. https://dx.doi.org/10.1177/1741143205048175

Weingaertner Carina, Moberg Åsa (2014). Exploring Social Sustainability: Learning from Perspectives on Urban Development and Companies and Products

https://doi.org/10.1002/sd.536

Weerainghe, A. & Ramachandra, T. (2018). Economic sustainability of green buildings: a comparative analysis of green vs non-green. Built Environment Project and Asset Management.

Wen S and Qiang G (2022) Managing Stakeholder Concerns in Green Building Projects With a View Towards Achieving Social Sustainability: A Bayesian-Network Model. Front. Environ. Sci. 10:874367. doi: 10.3389/fenvs.2022.874367

Wiley, J.W. & Kowske, B.J. & Herman, A.E.. (2010). Developing and validating a global model of employee engagement. 351-363.

Willis, C.J., & Rankin, J.H. (2011). Measuring the Maturity of Guyana ' s Construction Industry Using the Construction Industry Macro Maturity Model (CIM 3) *.

Wilson, D., Chowdhury, T., Elliott, T., Elliott, L. & Hogg, D. (2017). The New Zealand Waste Disposal Levy: Potential impacts of adjustments to the current levy rate and structure

Windapo A. O. (2014) Examination of Green Building Drivers in the South African Construction Industry: Economics versus Ecology Sustainability 2014, 6(9), 6088-6106; https://doi.org/10.3390/su6096088

Windapo[1] A. and Machaka[2] M. (2018). Conventional and Sustainable Buildings: A Comparative Benefit and Cost Analysis

World Commission on Environment and Development (2011).

Wu M.J., Zhao K. and Fils-Aime F. (2022). Response rates of online surveys in published research: A meta-analysis, Volume 7, 2022, 100206, https://doi.org/10.1016/j.chbr.2022.100206

Yadegaridehkordi Elaheh, Shahla Asadi, Seyedeh OmSalameh Pourhashemi, Mehrbakhsh Nilashi, Rusli Abdullah, Sarminah Samad, Nahla Aljojo, Nor Shahidayah Razali (2020). Investigating influence of green innovation on sustainability performance: A case on Malaysian hotel industry, Journal of Cleaner Production, Volume 258,https://doi.org/10.1016/j.jclepro.2020.120860.

Yamane T and Kaneko S (2022). The Sustainable Development Goals as new business norms: A survey experiment on stakeholder preferences, Ecological Economics, Volume 191, 2022, https://doi.org/10.1016/j.ecolecon.2021.107236.

Yamane, T. (1967). Statistics, an Introductory Analysis, 2nd Ed., New York: Harper and Row.

Yang, Rebecca & Shen, Geoffrey. (2014). Framework for Stakeholder Management in Construction Projects. Journal of Management in Engineering Projects. 31. 10.1061/(ASCE)ME.1943-5479.0000285.

Young M. (2015). What is learning and why does it matter? https://doi.org/10.1111/ejed.12105

Yudelson, Jerry & Fedrizzi, S. (2007). The Green Building Revolution. Bibliovault OAI Repository, the University of Chicago Press.

Yurdakul, M., & Kazan, H. (2020). Effects of Eco-Innovation on Economic and Environmental Performance: Evidence from Turkey's Manufacturing Companies. Sustainability, 12(8), 3167. https://doi.org/10.3390/su12083167

Zainab S, Pan W, Goodhew S and Fuertes A (2013) Stakeholders perspective on sustainable technology selection to achieve zero carbon retail buildings In: Smith, S.D and Ahiaga-Dagbui, D.D (Eds) Procs 29th Annual ARCOM Conference, 2-4 September 2013, Reading, UK, Association of Researchers in Construction Management, 1219-1229

Zenghelis D. (2016). Decarbonisation: Innovation and the Economics of Climate Change. https://doi.org/10.1111/1467-923X.12239

Zhao Xin-Xin, Jun Wen, Qiang Fu, Chun-Ping Chang (2022). The impact of extreme weather events on green innovation: Which ones bring to the most harm? Technological Forecasting and Social Change, Volume 188, https://doi.org/10.1016/j.techfore.2023.122322.

Zuo Jian and Zhao Zhen-Yu (2014), Green building research–current status and future agenda: A review, Renewable and Sustainable Energy Reviews, **30**, (C), 271-281