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Influence of housing policies, legislations, approaches and designs on sustainability of housing in Kenya.

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INFLUENCE OF HOUSING POLICIES, LEGISLATIONS, APPROACHES AND DESIGNS ON SUSTAINABILITY OF HOUSING IN KENYA

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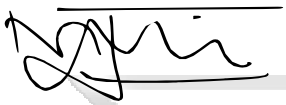
2025

DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

David Mathu Njuguna……  ……25.04.2025……

Approval

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DEDICATION

I dedicate this work to my beloved Family. Your unwavering support and encouragement have been a strong foundation that has anchored my entire academic journey in pursuit of this master's degree.

In a very special way, I dedicate this work to God Almighty for His enduring love, grace and favor upon my life! To You God be all the glory and honor forevermore.

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LIST OF ABBREVIATIONS

AAK	Architectural Association of Kenya
AFDB	African Development Bank
ABMT	Appropriate Building Materials and Technologies
BETA	Bottom Up Economic Transformation Agenda
BIM	Building Information Modeling
AHB	Affordable Housing Board
AHP	Affordable Housing Programme
CoG	Council of Governors
CSFs	Critical Success Factors
CPF	Central Provident Fund
CUE	Commission for University Education
EBK	Engineers Board of Kenya
EMT	Ecological Modernization Theory
EMCA	Environmental Management and Coordination Act
EPRA	Energy and Petroleum Regulatory Authority
EUI	Energy Use Intensity
GDP	Gross Domestic Product
GBRTs	Green Building Rating Tools
GoK	Government of Kenya
HDB	Housing and Development Board
HNCBO	Housing NGOs and Community Based Organizations
HVAC	Heating, Ventilation and Air Conditioning
IDT	Innovation Diffusion Theory
IEQ	Indoor Environmental Quality
IFC	International Finance Corporation
IOT	Internet of Things
IHDP	Integrated Housing Development Programme

IDK	Institute of Designers of Kenya
ILO	International Labour Organization
IEK	Institution of Engineers of Kenya
IQSK	Institute of Quantity Surveyors of Kenya
ISK	Institute of Surveyors of Kenya
KABCEC	Kenya Building and Civil Engineering Contractors
KAM	Kenya Association of Manufacturers
KARA	The Kenya Alliance of Resident Associations
KENSUF	Kenya Strategy for Sustainable Urbanization Framework
KENSUP	Kenya Slum Upgrading Programme
KETRB	Kenya Engineering Technology Registration Board
KFMB	Kenya Federation of Master Builders
KEPSA	Kenya Private Sector Alliance
KGBS	Kenya Green Building Society
KIPPRA	Kenya Institute of Public Policy and Research Analysis
KISIP	Kenya Informal Settlements Improvements Programme
KMRC	Kenya Mortgage Refinancing Corporation
KSHS.	Kenya Shillings
KPDA	Kenya Property Developers Association
KPI	Key Performance Indicator
KRA	Kenya Revenue Authority
LSK	Law Society of Kenya
LCC	Life Cycle Costs
LEED	Leadership in Energy and Environmental Design
LGFS	Light Gauge Framing System
LIHTC	Low-Income Housing Tax Credit
MCT	Measure of Central Tendency
NACOSTI	National Commission for Science, Technology and Innovation
NEMA	National Environmental Management Authority
NCA	National Construction Authority

NHC	National Housing Corporation
NHP	National Housing Policy
NITA	National Industrial Training Authority
NSUPP	Kenya National Slum Upgrading and Prevention Policy
NUDP	National Urban Development Policy
NZHs	Net Zero Homes
PPP	Public Private Partnerships
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PWI	Personal Wellbeing Index
RACECA	Roads and Civil Engineering Contractors Association
RDP	Reconstruction and Development Programme
REITs	Real Estate Investment Trusts
SACCO	Savings and Credit Cooperative Organizations
SDGs	Sustainable Development Goals
SDHUD	State Department of Housing and Urban Development
SIAH	Sustainable, Innovative, Affordable Housing
SHT	Smart Home Technology
SQM	Square Meter
SN	Serial Number
SSA	Sub-Saharan Africa
TCPAK	Town and County Planners Association of Kenya
TPS	Tenant Purchase Scheme
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
UN-HABITAT	United Nations Human Settlements Programme
UNHSP	United Nations Human Settlements Programme
UN	United Nations
USA	United States of America
VOC	Volatile Organic Compounds
WUI	Water Use Intensity

DEFINITION OF TERMS

Term Serial no.	Definition
Affordable housing	Housing that is made available for specific households with incomes that would not allow them to acquire appropriate housing in the general market (Gan et al. (2017).
Housing	A multi-dimensional product that includes physical shelter, the socio-economic and cultural dynamics, related services and infrastructure and the input required to produce and maintain it. It also includes the processes and outcomes of the production and use of residential dwelling (The Sessional Paper No. 3 of 2016 on National Housing Policy 2016).
Innovative Design Strategies	Creating environmentally friendly, energy-efficient, and socially inclusive living spaces. Innovative design strategies have been linked to sustainability in housing as they contribute to the efficient use of resources (Michael Tesfaye Bekele & Cemil Atakara, 2023; Lu et al., 2020).
Passive Designs	An approach that allows buildings to harness natural sunlight and heat, reducing the need for artificial lighting and energy consumption significantly (Adabre et al., 2020).
Smart Homes	A network of connected appliances that track energy consumption and the energy capacity of smart meters (Alkatheiri et al., 2021).
Sustainability of housing	Individual or groupings of self-sufficient "green buildings," or residential practices that are both environmentally and socially beneficial and incorporated into larger urban/settlement systems (UN-Habitat, 2012).
Sustainable Materials	Vital components of construction that minimize their impact on the planet and prioritize environmental responsibility (Suryandari, 2019).
Sustainability	Meeting the needs of today's generation without compromising the ability of future generations to meet theirs (Calderon & Chong, 2014).
Sustainability of Housing	Housing attribute of satisfying the requirements and expectations of the current generation without jeopardizing future generations' capacity to satisfy their own housing needs and demands (Adetooto et al., 2022)
Urban	A town, municipality or city as defined by the Urban Areas and Cities Act, 2011 (The Sessional Paper No. 3 of 2016 on National Housing Policy 2016).

ABSTRACT

Kenya continues to face significant challenges in achieving sustainable housing, despite various initiatives aimed at addressing the issue. This study examined the sustainability of housing in Kenya, focusing on the roles of policies, legislation, housing approaches, and design innovations. Guided by Ecological Modernization, Innovation Diffusion, and Gentrification Theories, the research employed a pragmatist philosophy and a mixed-methods approach, combining exploratory and descriptive designs to analyze both qualitative and quantitative data. Primary data was collected through site visits, surveys and focus group discussions. Quantitative findings indicated strong performance in environmental compliance and site planning but highlighted gaps in long-term economic planning, technological integration, and inclusive design practices. Thematic analysis identified eight major themes: conceptual understanding, enablers, policy and governance, financing, technology, global best practices, and urban planning dimensions of sustainable housing. Lexical analysis, utilizing word clouds, emphasizing people-centered and integrated urban development approaches. Despite alignment with global sustainability goals, Kenyan housing programs face challenges related to public participation, maintenance, and the adoption of innovative designs. Legislative frameworks are constrained by high compliance costs and fragmented governance, exacerbating exclusion for low-income populations. There is a thirty two percent chance that current laws, policies, methods, and designs will result in sustainable housing in Kenya. Although innovative design solutions exist, their application is hindered by cost and technical barriers. The study concludes by advocating for a holistic, people-centered housing policy that integrates environmental, economic, and social dimensions. It calls for legislative reform, technological adoption, and policy frameworks that bridge top-down governance with grassroots innovation to foster sustainable and inclusive housing in Kenya.

Key Words: Housing Policies, Legislative Frameworks, Housing Approaches, Design Innovations, Sustainability of Housing, Urban Development.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Sustainable housing is a fundamental pillar of the broader sustainable development agenda at both national and global levels. Its significance has been consistently highlighted in various United Nations documents and directives related to housing policies and programs (UNECE, 2015). As noted by Canton (2021), referencing UN-Habitat (2020), the global transition toward sustainable housing is largely shaped by sustainability frameworks such as the United Nations Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). These goals aim to ensure that all people have access to adequate, safe, and affordable housing. Boyack (2018) identifies governmental policy, design practices, and socio-economic conditions as key drivers influencing sustainable housing trends in relation to these SDGs.

The global urban population is projected to rise from 3.6 billion in 2011 to 6.3 billion by 2050, with most of this growth expected in developing nations (Abidoye et al., 2023). In response, countries such as the United States have embraced sustainable housing practices to address environmental, economic, and social challenges. These practices include the use of renewable materials, green building techniques, and resource-efficient technologies. Passarelli and Mouton (2023) highlight the increasing use of sustainable materials such as timber and earth-based substances as alternatives to non-renewable construction inputs. The Low-Income Housing Tax Credit (LIHTC) initiative in the U.S. has further promoted green standards in affordable housing (Yerena, 2024). Additionally, strategies such as rainwater harvesting, and water-efficient plumbing are widely adopted (Fulton et al., 2020). However, policy continuity often fluctuates with administrative changes, creating regulatory uncertainty (The White House, 2025).

In the United Kingdom, sustainable housing practices are central to the country's commitment to reducing environmental impact and achieving net-zero carbon emissions. Turner et al. (2024) highlight the use of energy-efficient designs, sustainable materials, and technological innovations. Similarly, in Germany, Scheller and Thorn (2018) examine self-build collectives and co-housing in Hamburg as successful models of community-led sustainable urban development, promoting both environmental sustainability and social

cohesion. In contrast, many African countries, including Kenya, Angola, Ghana, Zambia, and Libya, continue to grapple with the challenge of providing sustainable housing, particularly for low-income populations. Retno and Harmiyati (2023) emphasize the necessity of affordable, sustainable housing in developing economies. However, the adoption of unsustainable, post-colonial housing models has led to persistent inequalities and environmental inefficiencies (Khatib & Elsharkawy, 2020).

Housing sustainability appeals to both traditional and modern architecture. In Africa, traditional vernacular housing, while sustainable due to its use of locally available, renewable materials, often lacked essential amenities, posing health and sanitation risks (Steyn & Roodt, 2007). Integrating modern technologies into these models could bridge existing gaps in sustainability achievement without compromising environmental sustainability.

In Kenya, the housing shortage has become a critical concern. As of the early 2000s, there was an estimated deficit of 300,000 housing units for Nairobi's 4 million residents (Kieti et al., 2020). The country continues to experience a significant mismatch between housing supply and demand. Kieti et al. (2020) report that while the annual demand for new housing is 250,000 units, only 50,000 are produced annually, leading to a cumulative deficit of 2 million units. Furthermore, 83% of new housing targets high-income groups, with only 2% designated for low-income populations. As a result, only 21.3% of urban residents own homes, while the remaining 78.7% are renting tenants (GoK, 2018b; 2022).

The conventional classification of housing into high-, middle-, and low-income categories is increasingly viewed as a limiting and elitist approach. Instead, a shift toward standardized but flexible housing typologies is recommended, typologies that allow modular space usage tailored to diverse household needs (World Bank, 2019). These flexible units could improve affordability, occupancy, and resource efficiency while promoting social integration. Traditional one-size-fits-all housing models lack adaptability and often do not meet the real needs of residents. Many occupants eventually return to informal settlements, which offer more flexibility (Gulyani, Talukdar, & Jack, 2018). By adopting scalable, modular housing solutions, governments could reallocate resources toward improving essential public services, thereby enhancing urban resilience (UN-Habitat, 2020).

Although homeownership is widely perceived as a desirable goal, it is not always a feasible or sustainable policy for all citizens, especially in emerging economies. Angel (2021) asserts that while ownership provides security, it must be balanced with the practicality and efficiency of access-based models. The growing cost of urban land, evolving employment structures, and the need for geographic mobility make flexible housing models such as lease-to-own, co-housing, and cooperative rentals increasingly attractive (ILO, 2021; SPARC, 2022). As counties in Kenya implement land and property taxes, the financial burden of urban homeownership will increase, encouraging more families to rent urban homes while maintaining rural residences for family gatherings and long-term security.

The absence of integrated housing and urban transportation planning in Kenya further compounds the challenge. The lack of reliable public transportation forces many workers to acquire multiple dwellings across urban areas, increasing pressure on already limited housing stocks (African Development Bank, 2020). Holistic policy frameworks must, therefore, incorporate both housing and transportation to foster economic decentralization, reduce congestion, and improve overall livability.

Determinants of housing sustainability operate at the macro and micro economic levels of the construction industry of Kenya. Previous studies in the housing sector (Ondola et al., 2013, Burugu, 2015 & Aggar et al., 2023) highlight four factors, as follows: housing policies, housing legislations, housing approaches and housing designs. However, it is not clear whether the factor levels are adequate for effective achievement of housing sustainability in the country. Additionally, leverage points in the system(s) of housing sustainability remain uncertain. Hence, the need for further research in this area.

1.1.1 Existing Housing Policies and Legislation in Kenya

According to Article 43 and Chapter 4 of the 2010 Kenyan Constitution, each and every individual has a right to accessible and sufficient housing and up to acceptable hygienic standards ("Constitution of Kenya," 2010). Additionally, in order to gradually fulfill the rights outlined in Article 43 of the Constitution, the State is required under Article 21(2) to put legislative, policy, and other relevant measures into place, including the creation of standards. According to Kieti et al. (2020), the Kenya Government under its Jubilee

Administration's Big Four Agenda on Housing called for the development of adequate, standardized housing in addition to a steady supply of power and water. This aspiration has been carried forward under the current Kenya Kwanza Government Manifesto GoK (2022) and is currently being operationalized under the Affordable Housing Act of 2024 and the Housing Act CAP 117 of the Laws of Kenya. In addition, Sessional Paper No. 3 of 2004 on the National Housing Policy had to be revised following the promulgation of the new Constitution.

The Housing Act CAP 117 establishes the National Housing Corporation (NHC) as the principal agency of the government of Kenya in implementation of housing policies and programmes. However, most recently the enactment of the Affordable Housing Act of 2024 established a Fund to be managed by the Affordable Housing Board (AHB), In addition to NHC the Act has listed other institutions for implementation of affordable housing programme including the County Governments, the State Department of Housing and Urban Development (SDHUD), the private sector among others. As per NHC's strategic plan 2023-2027, the Corporation intends to build housing units through the housing levy, internally generated funds, private sector collaborations (alliances, partnerships, and PPPs etc.) to fulfill its mission of offering both commercial and social housing that is inexpensive. The strategy also aims to use housing development to reduce poverty, improve the living conditions, and generate jobs (Kieti et al., 2020).

The origin of Kenya's housing policy can be tracked back to Sessional Paper No. 5 of 1966 -1967, which outlined the government's responsibility to directly provide affordable and adequate housing for its Citizens in the post-independence period. Since housing is a constitutional right under Article 43(1)(b) the national housing policy is designed to promote sustainable human settlements by ensuring that all socioeconomic groups can have access to affordable and decent housing and live in a healthy environment (Omagwa, 2021a). The revised sessional paper No. 3 of 2016 modernized housing policy to align with constitutional mandates, Kenya Vision 2030, and legislative frameworks such as those governing Real Estate Investment Trusts (REITs). This policy update resulted from extensive consultations to ensure it was both relevant and consistent with other legal and policy frameworks. Its overarching goal was to fulfill the Constitution's housing obligations and improve the quality of life for Kenyans.

Specific objectives included enabling access to decent, affordable housing; expanding and maintaining the housing stock; promoting the development of environmentally sustainable, mixed-income housing; and creating an efficient legal and administrative framework to support housing development by both the public and private sectors (Omagwa, 2021a).

In examination of creating more sustainable social housing in Serbia, Njegic (2022) identified pertinent criteria for reviewing literature on sustainable social housing design. The criteria was systematically organized and interpreted to align with Serbia's specific context and needs. The study established that there was insufficient application of legislation on sustainability criteria in Serbia's social housing sector. They developed a conceptual multicriteria framework to enhance existing policies in designing and evaluating social housing settlements and buildings.

According to National Housing Corporation (2023), the National Housing Policy (2004, Revised 2016) provides that National and County Governments will establish a unified regulatory and institutional framework to improve cooperation, enforce compliance, and define industry standards. As a policy direction, the National and County Governments will continually examine construction rules and regulations to align with the changing construction environment, including the private sector and developing technologies. The Strategic Plan identifies Kenya's major housing policies and legislation to include among others: National Housing Policy (2004, Revised 2016), the Affordable Housing Programme (The Big Four Agenda, 2018 and The Bottom-Up Economic Transformation Agenda 2022), Kenya Vision 2030, the National Urban Development Policy (NUDP, 2016), and the Slum Upgrading Policy, The Constitution of Kenya (2010), The Housing Act CAP (117), Architects & Quantity Surveyors Act, Cap. 525, Community land Act No. 27 of 2016, Engineers Act, 2011, Environmental Management and Coordination Act (EMCA) No. 8 of 1999, National Construction Authority Act No. 41 of 2011, Physical Planning Act No. 6 of 1996, Survey Act Cap. 299, Water Act No. 43 of 2016, Lands Act No. 6 of 2012, Land Registration Act No. 3 of 2012, Urban Areas and Cities Act (2011, Amended 2019), Physical and Land Use Planning Act (2019), Building Code (1968, Revised 2024), Public-Private Partnerships Act (2021), and Kenya Mortgage Refinance Company Act (2018).

1.1.2 Innovative Design Strategies

Innovative design strategies in housing are geared towards creating environmentally friendly, energy-efficient, and socially inclusive living spaces. According to Rakesh Sai Kumar Mandala and R. Ramesh Nayaka (2023), such designs prioritize resource-efficient construction techniques and modular construction, which reduces waste and energy consumption.

Since independence in Kenya, building has been regulated by the Local Government Authority based on the building code Erastus and Pu (2014) which was developed based on the British Imperial Codes that were in effect at the time. A building code is a system of laws and regulations that establishes the minimal standards of safety that must be met by buildings and structures. Erastus and Pu (2014) identify several flaws in the existing building code including First, Kenya now uses the metric system (meters), but the Adoptive By-laws of 1969 adopted the Imperial units (feet and inches) as the International System of Units (SI) measurements. Second, the introduction of new building materials in the market makes it challenging to create a well-designed structure based on the Ministry of Local Government (1969) building code because the code's design perspective is material-based, and some materials were not taken into consideration. Third, the use of British building codes in material specifications is costly. The code specifies rules for materials that are either costly or imported from European design standards. Additionally, the code stipulates that the structure must be constructed of masonry (natural stone) and include a minimum of two (2) bedrooms, each measuring at least 7 m2, a separate kitchen, and flue ventilation in order to meet the minimum dwelling criteria. This requirement is too harsh for low- and middle-class families to adhere to, as it is out of their income range (Erastus & Pu, 2014).

The Intermediate Technology Development Group (ITDG) took the initiative to begin implementing building methods that complied with living standards in 1990. Although Code 95 was created and authorized by the legislature in 1995, the building sector did not take its adoption and execution seriously (Erastus & Pu, 2014). To address the gap occasioned by adoption of the existing building code, the study seeks to examine the possibility of adopting innovative design strategies towards sustainability of public

housing. Extant literature (Eg., Aggar et al., 2023; Romero et al., 2023) identifies innovative design strategies to include; passive design, green building materials, energy efficient systems, water conservation, urban green spaces, mixed use developments, resilient design, and community involvement to mention but a few. The current study shall focus on four elements of innovative design strategies; modular construction, sustainable materials, smart home technology, sustainable housing and passive designs, because they can have the greatest potential influence on sustainability of the Kenyan housing model.

Innovative design strategies have been linked to sustainability in housing as they contribute to the efficient use of resources (Bekele &Atakara, 2023; Lu et al., 2020). Literature enumerates a wide spectrum of innovative design strategies, but the current study shall focus on four strategies: modular construction, sustainable materials, smart homes technology and passive designs. Modular construction is an innovative building strategy which involves producing structures in factories off-site, then transporting and assembling them on-site. Sustainable building materials are those that minimize the impact of housing on the planet and prioritize environmental responsibility (Suryandari, 2019). These materials are sustainable because they are eco-friendly and renewable, have low environmental impact, are energy efficient, are durable, and can be locally sourced. A smart home is described by Alkatheiri et al. (2021) as a network of connected appliances that track energy consumption and the energy capacity of smart meters. Last, passive solar design strategies are a sustainable approach that reduces energy consumption and artificial lighting in buildings. They can lower operating costs, improve reputation, and minimize environmental impact.

1.1.3 Sustainable Housing in Kenya

Sustainable housing refers to individual or groupings of self-sufficient "green buildings," or residential practices that are both environmentally and socially beneficial and incorporated into larger urban/settlement systems (Mandala & Nayaka, 2023; Suryandari, 2019). According to Haidar and Bahammam (2021) sustainable housing is an approach that is inclusive and reasonably priced for all people, while also limiting the negative environmental effects of building and offering sufficient access to

opportunities and services. Sustainable housing combines eco-friendly building techniques and affordability to solve social and environmental issues. In addition, sustainable housing considers needs for a respectable standard of living—needs that are fundamental and impossible to disregard but may not be economically quantifiable. Sustainable housing, therefore, incorporates three key dimensions: environmental, economic, and social sustainability (Gan et al., 2017).

Environmental sustainability within the domain of housing emphasizes the imperative of minimizing the ecological footprint associated with residential edifices through the implementation of energy-efficient practices, conservation of resources, and reduction of waste (Smith, 2023). Sustainable housing methodologies prioritize the reduction of environmental impacts by employing eco-friendly materials, designs that promote energy efficiency, and avant-garde construction techniques. Environmental sustainability in housing encompasses green building techniques, material selection, and innovative designs. Green building methodologies integrate energy-efficient materials and renewable energy systems, such as photovoltaic panels, which substantially diminish operational expenses and ecological footprints, whereas high-performance insulation significantly alleviates energy usage and greenhouse gas emissions (Patel et al., 2024).

The selection of materials entails the adoption of locally sourced and certified eco-friendly components to mitigate carbon emissions linked to construction activities (Rifkah, 2024). Furthermore, innovative design attributes such as ventilated double-skin facades improve energy efficiency by optimizing thermal performance (Mishra et al., 2024), while additionally, the incorporation of water-efficient fixtures, rainwater harvesting systems, and sustainable land use strategies further bolsters environmental sustainability (Kibert, 2016).

Economic sustainability in housing involves the amalgamation of economic viability, environmental stewardship, and social justice within the domain of housing development (Ullah, 2024). This multifaceted approach is imperative for meeting the escalating demand for affordable housing while concurrently safeguarding long-term advantages for both communities and the environment. The critical components of

economic sustainability in housing are delineated by Ullah et al. (2024) to include governmental policies, innovative practices, and the significance of public-private partnerships (PPT). Governmental interventions are pivotal in directing sustainable housing initiatives, particularly in contexts where policies markedly affect developmental outcomes. Economic variables, such as cost-effectiveness and affordability, are characterized by Singh et al. (2024) as essential for fostering sustainable housing, thereby ensuring that developments remain financially attainable for economically disadvantaged populations.

Innovative practices, which integrates green building standards and energy-efficient designs within affordable housing initiatives, illustrates that sustainability can harmoniously coexist with economic feasibility. Public-Private Partnerships, as noted by Akinsulire et al. (2024), involve collaborative efforts between governmental entities and private enterprises to enhance the efficacy of sustainable housing initiatives, effectively mobilizing resources and expertise to surmount financial and regulatory obstacles. Such collaborations are vital for mitigating the initial financial burdens associated with sustainable construction practices, which may otherwise impede investment in affordable housing developments.

Social sustainability in housing is a multifaceted concept that emphasizes the quality of life within communities, focusing on social interactions, inclusivity, and community cohesion. It is an essential pillar of sustainable development, alongside environmental and economic sustainability. Social sustainability in housing according to Makalima (2024) creates environments that foster social relationships, provide psychological comfort, and enhance community building. This can be achieved through the integration of informal social spaces, prefabricated housing solutions, and attention to mass housing projects. Informal social spaces such as meeting places, religious sites, and areas for informal enterprises are crucial for enhancing social sustainability. These spaces according to Veluru and Karki (2023) promote social interactions and cohesion, contributing to the establishment of social capital within neighborhoods.

Ziaesaeidi and Farsangi, (2024) presents prefabricated housing as offering potential for social sustainability by being adaptable and accessible, encouraging interaction and

participation among residents. This housing model can foster a sense of belonging and social cohesion, although it requires further research to fully understand its impact on social sustainability. Mass housing projects are described by Oksuz and Sari (2023) as housing units which prioritize economic efficiency, spatial diversity and which can lead to socially unsustainable environments.

Smets and van Lindert (2016) considers sustainable homes as ones that are: utilizing ecological low-energy and cost-effective building materials and technologies; being resilient to potential natural disasters and climate impacts; being connected to decent, safe, and affordable energy, water, sanitation, and recycling facilities; making the most efficient use of energy and water; having certain on-site renewable energy generation and water recycling capabilities; not polluting the environment and protected from external pollution; being suitably located in terms of jobs, shops, health and childcare facilities, schools, and other services; appropriately integrated into and bolstering the social, cultural, and economic fabric of the surrounding neighborhood and larger urban areas; and well-maintained, timely renovated and retrofitted (Adabre et al., 2020; De Zoysa et al., 2023).

There is no consensus in literature on an explicit metric to measurement of sustainable housing, though numerous approaches have been adopted across the globe. Galster and Ok Lee (2020) posits that the most important metrics and indicators utilized in measuring sustainable housing must encompass energy efficiency, environmental impact, affordability, resilience to climate change, access to basic services, social economic integration and quality of life. Hristov and Chirico (2019) identified several Key Performance Indicators (KPI) for sustainable housing and proposed the following as key measures of sustainable housing, energy efficiency, indoor air quality, affordability, community integration, resilience to climate change, construction waste management, green space provision and water conservation. With Kenya's growing economy and one of the fastest-growing urbanization rates in the continent (4.3 percent year) and with about 27 percent of the population living in urban areas, the demand for sustainable housing has never been greater (GoK, 2018; Kieti et al., 2020). Adamec et al. (2021) in a study on how to measure sustainable housing, presented five measures.

First, Energy Use Intensity (EUI): This metric quantifies the energy consumed per square foot per year, reflecting a building's operational efficiency. Sustainable housing aims for lower EUI through enhanced insulation, high-performance windows, and energy-efficient HVAC systems. Second, Embodied Carbon Footprint: This measures the greenhouse gas emissions associated with the entire lifecycle of building materials, from extraction to installation. Utilizing materials with low embodied carbon, such as wood or recycled products, is a priority in sustainable construction. Third, Water Use Intensity (WUI): This KPI assesses indoor water consumption, emphasizing the importance of efficient fixtures, rainwater harvesting, and greywater recycling to minimize usage. Fourth, Indoor Environmental Quality (IEQ): Focusing on occupant health and comfort, IEQ includes metrics related to air quality, thermal comfort, and natural lighting. Sustainable designs enhance natural ventilation, reduce volatile organic compounds (VOCs), and maximize daylight access. Fifth, Waste Diversion Rates: This metric evaluates the effectiveness of waste reduction and recycling efforts during construction and demolition, aiming to minimize landfill contributions.

1.2 Statement of the Problem

Despite numerous policy initiatives, legislations and developmental efforts - such as the National Housing Policy, National Urban Development Policy, the Affordable Housing Programmes (AHP), establishment of implementing agencies such as the State Department of Housing and Urban Development (SDHUD), National Housing Corporation (NHC), Affordable Housing Board (AHB), County Governments, and interventions such as Kenya Slum Upgrading Programme (KENSUP) and Kenya Informal Settlements Improvements Programme (KISIP) - housing sustainability in Kenya remains critically low. According to the United Nations Sustainable Development Report 2024, the country's sustainability performance in SDG 11 (sustainable cities and communities) is rated at 52% and is categorized as facing major challenges and showing a stagnating trend that requires further intervention (Sachs et al., 2024). This is most visibly reflected in the acute housing shortage, which disproportionately affects low- and middle-income populations thus driving increased informal settlements and mushrooming of slum dwellings.

Several interrelated factors contribute to this crisis, including market failures (Talukdar,

2018), limited private sector engagement in social housing, inadequate infrastructure investment, rapid population growth, and poor governance. Mazzucato and Penna (2016) argue that government interventions are essential in instances of market failure, particularly when the market cannot supply goods such as sustainable housing at optimal levels. These challenges are not unique to Kenya. Ugochukwu and Chioma (2015) posit that in many developing nations in Africa, Asia, and South America, housing crisis is escalating unabated despite a number of new policies, laws, programs, and strategies employed by both the public and private sectors. Njegic et al. (2022) identified insufficient implementation of sustainability benchmarks in urban social housing in post-socialist Serbia as a driver of emergence of inferior and low-caliber housing projects. The authors underscored the imperative of incorporating social, economic, and environmental sustainability dimensions into the prevailing social housing development frameworks.

In Kenya, several studies (Omagwa, 2021; Bera et al., 2024; Kieti et al., 2020) have explored housing programs but they tended to focus on isolated drivers of sustainability such as policy or bioclimatic variables. Such an approach created conceptual and empirical gaps in housing research in Kenya. To address this gap, the current study has integrated and analyzed housing policies, legislation, approaches, and design innovations simultaneously and examined their contribution to sustainability of housing in Kenya resulting in more nuanced understanding of the housing phenomenon in the country.

1.3 Research Objectives

This study was guided by both a general objective and specific objectives.

1.3.1 General Objective

To investigate the level of sustainability of housing in Kenya and examine how policies, legislation, housing approaches, and design innovations influence it, with the aim of enhancing sustainability outcomes in the sector.

1.3.2 Specific Objectives

i. To assess the level of sustainability in housing development in Kenya.
ii. To examine the contribution of existing housing policies to sustainability of housing in Kenya.

iii. To evaluate the contribution of current housing legislation to sustainability of housing in Kenya.

iv. To assess the contribution of prevailing housing approaches to sustainability of housing in Kenya.

v. To determine the role of housing design innovations in promoting sustainability of housing in Kenya.

1.4 Research Questions

In this study, the main research question is why housing sustainability in Kenya remains an all-time low. The specific research questions are as follows:

i. What is the level of sustainability in housing developments in Kenya

ii. To what extent have the existing housing policies contributed to sustainability of housing in Kenya?

iii. To what extent have the existing housing legislations contributed to sustainability of housing in Kenya?

iv. To what extent have the existing housing approaches contributed to sustainability of housing in Kenya?

v. To what extent have housing design innovations contributed to sustainability of housing in Kenya?

These are the questions which guided the data collection and analysis in the study, using objective and subjective measures of the variables at play.

1.5 Significance of the Study

This study is anticipated to offer substantial contributions to various stakeholders in the housing sector, including managers, policymakers, scholars, and researchers. The insights generated from this research will inform decision-making processes, influence policy reforms, and contribute to academic knowledge on sustainable housing in Kenya.

1.5.1 Managers of Housing Programmes

The findings of this study will be particularly valuable to managers involved in the planning, implementation, and oversight of housing initiatives in Kenya. Housing developers,

professionals, contractors and financiers will benefit from evidence-based insights in adoption of sustainability strategies spanning environmental, social and economic paradigms such as adoption of modular construction techniques, waste reduction and energy conservation. The study will also provide critical guidance on the selection of alternative construction materials that are not only cost-effective but also sustainable from a lifecycle economic perspective.

Furthermore, it will shed light on effective sustainable design approaches and innovations, enabling managers to implement resource-efficient and socially cohesive communities. This, in turn, has the potential to reduce project costs, improve housing quality, and enhance long-term sustainable housing outcomes.

1.5.2 Policy Makers

At both the county and national levels, the study offers a valuable assessment of current housing policies and legislative frameworks, identifying key areas of success and highlighting those in need of reform to promote sustainability of housing. The findings will inform the formulation, revision, and implementation of housing-related policies, laws, standards, and guidelines, addressing issues such as affordability, green financing, decarbonization, economic viability and social inclusivity. By critically examining existing building regulations, including outdated frameworks like the 1968 Building Code which has recently been replaced by a 2024 version, the study advocates for continued modernization of codes that incorporate sustainable construction practices. Further, it underscores the importance of policy incentives that support adoption of innovative design strategies, including modular construction, sustainable construction materials, smart housing technologies and passive solar design strategies. These insights will contribute to shaping a policy environment conducive to achieving long-term housing sustainability in Kenya.

1.5.3 Researchers and Academicians

This study contributes to the growing body of scholarly literature on sustainable housing and urban development. It serves as a foundational reference for future research in sustainability of housing. Researchers will be able to expand upon the findings to explore specific themes such as the socio-economic outcomes of sustainable housing or the effectiveness of various construction technologies in driving sustainability. Additionally, the study opens avenues for

comparative research across counties or international contexts borrowing from identified best practices. Academic institutions can also leverage the findings to design curricula that prepare learners and practitioners with the theoretical knowledge and practical skills necessary for the implementation of sustainable housing solutions.

1.6 Assumptions of the Study

This study was guided by several underlying assumptions that provided the foundational context for interpreting the study findings: First, it was assumed that Kenya had existence of a policy and legislative framework contributing directly or indirectly to sustainability of housing. Second, the study assumed that key stakeholders in the housing sector possessed an understanding of existing housing related policies, legislative instruments, housing approaches, and design innovations, and that they were willing to freely share information to inform the study. Third, the study assumed that there was a contribution by policies, legislations, housing approaches, and designs on the level of sustainability achieved in housing developments in Kenya.

1.7 Scope of the Study

The research was conducted within the Kenyan context, with a focus on policies, legislative frameworks, housing approaches and innovative design strategies and their contribution to sustainable housing development. The study was grounded on three theories: Ecological Modernization Theory, Innovation Diffusion Theory, and Gentrification Theory. Key stakeholders in Kenya's housing sector were engaged, including government ministries, state departments, parastatals, private sector players, professional associations, civil society and development partners (Appendix VI). The study employed exploratory and descriptive research designs based on qualitative and quantitative data drawn from focus group discussions, site observations and survey questionnaires. This methodological triangulation was intended to enhance the credibility and validity of the findings by integrating diverse data sources, analytical methods, and perspectives. The study was carried out between November 2024 and April 2025.

1.8 Outline of the Study Report

The study report comprises five chapters. Chapter I discusses the background of the study and presents the concept of housing sustainability, its status in Kenya, and the research problem

investigated in the study is stated. Additionally, the research objectives and their corresponding questions are given, and the study justification and scope explained. Chapter II presents reviews of related general theories and empirical studies previously carried out in this area. Factors that influence housing sustainability are reviewed, knowledge gaps in the literature outlined, and the conceptual framework for the study formulated. Chapter IV discusses the research methodology used to conduct the study. It consists of research design, research methods, data collection and analyses procedures and ethical consideration in conducting the study. Chapter IV presents data analysis and research findings, while Chapter V presents the conclusions of the study, and its recommendations based on the findings.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter a review of theoretical literature and empirical literature on housing policies, legislation, approaches and designs and their influence on housing sustainability is presented. The chapter comprises five main sections: theoretical review, empirical review, research gap, problem tree and conceptual framework.

2.2 Theoretical Review

This study was underpinned by three theories namely, Ecological Modernization Theory, Innovation Diffusion Theory and Gentrification Theory.

2.2.1 Ecological Modernization Theory

Ecological Modernization Theory (EMT), first introduced by Mol and Sonnenfeld (2000), offers a contemporary perspective on the link between environmental sustainability and economic development. Traditional views held that environmental protection and economic growth were mutually exclusive. However, EMT posits that the two can be harmonized through the implementation of ecofriendly technologies, green innovations and technologies, and supportive institutional frameworks. At its core, EMT emphasizes the concept of environmental reformism, which suggests that environmental regulations should not be seen merely as constraints on economic growth, but rather as catalysts for technological innovation, operational efficiency, and long-term competitiveness.

According to EMT, developers and industries that adopt cleaner production technologies and sustainable practices can not only comply with environmental standards but also benefit from cost savings and enhanced attractiveness (Mol & Sonnenfeld, 2000; Spaargaren & Mol, 2008). Crucially, EMT also recognizes the essential role of governance structures, institutions, and policy frameworks in enabling the transition to sustainability. Regulatory incentives, environmental standards, and policy coherence are seen as drivers that can encourage developers and industries to voluntarily adopt environmentally responsible practices (Spaargaren & Mol, 2008).

Despite its widespread use, EMT has been critiqued by a few scholars. York and Rosa (2003) observe that EMT is overly optimistic about the capacity of technological innovation

to resolve ecological crises without addressing the systemic contradictions of capitalism. It assumes that environmental degradation is primarily a result of inefficient or outdated technologies, rather than the inherent growth imperative of capitalist economies. This leads to a reliance on eco-efficiency and decoupling strategies, which empirical studies have shown to be insufficient for achieving absolute reductions in resource use and emissions at a global scale (Jackson, 2009).

In the context of this study, the critiques notwithstanding, EMT is particularly relevant in understanding how policies, legislations, housing approaches and innovativeness of design strategies can contribute to sustainability of housing in Kenya. The theory provides a framework for analyzing how innovative building methods such as modular construction, use of sustainable materials, passive design, and integration of smart technologies can enhance environmental performance while also yielding economic and social benefits to the housed communities. For instance, in Kenya's rapidly urbanizing context, such innovations may help reduce construction costs, shorten project timelines, improve energy efficiency, and increase market appeal of the built infrastructure (Fan et al., 2022; Uche et al., 2023).

Moreover, EMT draws attention to the critical role of national and county governance in supporting these innovations. Through well-formulated and implemented housing policies, building codes, and urban development legislation, governments can foster an enabling environment for ecological modernization in the housing sector. This makes EMT a valuable theoretical lens for evaluating how policies, laws, housing approaches and design interventions can align to advance the sustainability of housing in Kenya.

2.2.2 Innovation Diffusion Theory

The Innovation Diffusion Theory (IDT), developed by Rogers (1962) provides valuable information on how new ideas and practices spread within societies. This theory is a widely recognized framework that explains how new innovations or ideas spread and are adopted within a society or a social system. At the core of IDT are five key attributes that influence the rate of new innovation adoption: relative advantage, compatibility, complexity, trialability, and observability. These attributes collectively help predict and understand adoption of sustainable practices in Kenya for example how quickly and

effective innovative design strategies such as modular construction, sustainable materials, and smart home technology, can be embraced to drive sustainability in housing.

The theory is equally important in revealing barriers to adoption of sustainability practices thereby informing design of policies and regulatory frameworks such as tax and subsidy incentives for green buildings, regulations mandating energy efficient standards and awareness campaigns to accelerate uptake of sustainable housing innovations and technologies. For instance, the theory suggests that if policy and legal provisions, housing approaches and design strategies offers a clear relative advantage over traditional methods (like cost savings or improved quality), are compatible with the existing infrastructure, are less complex in adoption, are triable on small scale before full adoption and the benefits say in driving high standards of living are observable they are more likely to be adopted by housing stakeholders in the country (Rogers, 1962; Williams et al., 2022).

A central critique of IDT is its linear and staged model of adoption (i.e., innovators to laggards), which tends to oversimplify the complex, recursive, and socially embedded nature of innovation processes (Greenhalgh et al., 2004). This model assumes a rational decision-making process driven by perceived attributes of the innovation (in terms of relative advantage, compatibility), but neglects the influence of power dynamics, cultural meanings, and institutional constraints that often shape adoption decisions (Lyytinen & Damsgaard, 2001).

The Innovation Diffusion Theory also recognizes the role of communication channels, opinion leaders and change agents in influencing innovation adoption. This suggests that Kenya could leverage on key stakeholders and partners in housing development such as policy makers, professionals, financiers, contractors, civil society, regulators among others to drive effective communication and knowledge sharing for the effective diffusion of sustainable practices and technologies in the housing sector. By examining policies, legislations, approaches and design from a theoretical perspective of IDT, the current study provides insights into how the four variables could be innovatively designed and diffused to contribute to the sustainability of housing in Kenya.

2.2.3 Gentrification Theory

Gentrification theory provides a critical lens through which to understand and explain the complex dynamics of urban transformation, particularly in relation to housing development and sustainability. Developed by British sociologist Ruth Glass in 1964, the term originally described the influx of middle-class residents into traditionally working-class neighborhoods in London, leading to the displacement of lower-income populations. Over time, the concept has evolved to include broader socioeconomic shifts driven by residential mobility, capital investments, and state intervention in development of urban spaces and facilities.

Gentrification is characterized by both the physical and social upgrading of low-income neighborhoods, often resulting from housing interventions, infrastructural development, and real estate speculation. In many developing countries, including Kenya, gentrification has become an unintended consequence of urban redevelopment and regeneration efforts such as slum upgrading, infrastructure improvement, in some cases anchored in public-private housing initiatives.

Scholars have dualized gentrification conceptualizing it through both supply-side and demand-side perspectives. Supply-side theories emphasize the role of housing availability, urban policy, and investment strategies, while demand-side approaches focus on changing residential preferences, demographic shifts, and lifestyle choices (Lees et al., 2016; Butler, 2007). For instance, the expansion of higher education and low levels of employment in rural and peri-urban areas has increased the number of young professionals residing in cities, thereby driving demand for better- quality housing (Smith, 1996).

The supply of housing, influenced by government policies, urban planning regulations, and development approaches, plays a significant role in shaping gentrification patterns. Government-backed private sector investments have historically driven the initial phases of gentrification, particularly in inner-city areas (Hackworth & Smith, 2001). In recent years, the commodification of housing has intensified, with developers and private investors viewing gentrification as a profitable enterprise (Hamnett, 2021;

Aalbers, 2019). As a result, housing markets have expanded beyond core urban centers, often without adequate consideration of the long-term social sustainability of affected communities.

A key critique of this theory is the tendency of early gentrification theories, particularly those informed by Smith (1979) rent gap hypothesis to overemphasize economic determinism and capital flows at the expense of cultural and social dynamics. While Smith's structuralist perspective illuminates the role of capital reinvestment in urban space, it downplays the agency of individuals and the cultural drivers of neighborhood change emphasized by more consumption-oriented frameworks (Ley, 1996). This division has led to a false binary between production- and consumption-based explanations, obscuring more integrated, multi-scalar processes. Despite these shortcomings. y, governments have emerged as key actors in facilitating gentrification, either directly through policy and infrastructure projects or indirectly through incentives for private sector investment (Teernstra & Van Gent, 2012). In many cases, urban improvement is framed as a policy objective, yet the outcomes can include displacement of vulnerable populations and the erosion of social fabric in historically low-income neighborhoods (Hackworth & Smith, 2001).

In the context of this study, gentrification theory is instrumental in assessing how existing housing policies, legislative frameworks, planning approaches, and innovative housing designs impact the sustainability of housing. While well-intentioned housing interventions may enhance physical infrastructure and environmental quality, they may also trigger socio-economic exclusion, rising housing costs, and displacement if not carefully managed. Thus, an understanding of gentrification is essential for evaluating the long-term social, economic, and environmental sustainability of housing development in Kenya.

2.3 Empirical Literature

An overview of previous research on sustainability of housing, existing housing policies, legislation, approaches and innovative designs in the country, is provided in this section.

2.3.1 Sustainability of Housing in Kenya

Sustainable housing refers to individual or groupings of self-sufficient "green buildings," or residential practices that are both environmentally and socially beneficial and incorporated into larger urban/settlement systems (Mandala & Nayaka, 2023; Suryandari, 2019). According to Haidar and Bahammam (2021) sustainable housing is an approach that is inclusive and reasonably priced for all people, while also limiting the negative environmental effects of building and offering adequate access to opportunities and services.

The goal of sustainable development of housing is to strike a compromise between the necessity of providing decent, reasonably priced housing and the need to lessen environmental effect and advance social justice (Akinsulire et al., 2024). According to Di Foggia (2018), integrating sustainability into housing plans can minimize the ecological impact of new buildings while increasing energy efficiency, lowering operating costs, and improving tenants' overall quality of life. Implementing creative design concepts, utilizing green technologies, and embracing behaviors that support resilience and long-term environmental stewardship are all part of this integration (Souto, 2022).

Sustainable housing combines eco-friendly building techniques and affordability to solve social and environmental issues. In addition, sustainable housing considers needs for a respectable standard of living needs that are fundamental and impossible to disregard but may not be economically quantifiable. Sustainable housing, therefore, incorporates three key dimensions: environmental, economic, and social sustainability (Gan et al., 2017).

Environmental sustainability within the domain of housing emphasizes the imperative of minimizing the ecological footprint associated with residential developments through the implementation of energy efficient practices, conservation of resources, and reduction of waste (Smith, 2023). Sustainable housing methodologies prioritize the reduction of environmental impacts by adopting ecofriendly materials, designs that promote energy efficiency, and innovative construction techniques. Environmental sustainability in housing encompasses green building techniques, material selection, and innovative designs. Green building methodologies integrate energy efficient materials and renewable energy systems, such as photovoltaic panels, which substantially diminish operational expenses and

ecological footprints, whereas high-performance insulation significantly alleviates energy usage and greenhouse gas emissions driving decarbonization (Patel et al., 2024).

The selection of materials entails the adoption of locally sourced and certified environmentally friendly components to mitigate carbon emissions linked to construction activities and logistical operations (Rifkah, 2024). Furthermore, innovative design attributes such as ventilated double-skin facades improve energy efficiency by optimizing thermal performance of housing developments (Mishra et al., 2024), while additionally, the incorporation of water-efficient fixtures, rainwater harvesting systems, and sustainable land use strategies further bolster environmental sustainability (Kibert, 2016).

Economic sustainability in housing involves the amalgamation of economic viability, environmental stewardship, and social justice within the context of housing development (Ullah, 2024). This multifaceted approach is imperative for meeting the escalating demand for affordable housing while concurrently safeguarding long-term benefits for both communities and the environment. The critical components of economic sustainability in housing are delineated by Ullah et al. (2024) to include governmental policies, innovative practices, and the significance of public private partnerships (PPP). Governmental interventions are pivotal in directing sustainable housing initiatives, particularly in contexts where policies markedly affect developmental outcomes. Economic variables, such as cost-effectiveness and affordability, are characterized by Singh et al. (2024) as essential for fostering sustainable housing, thereby ensuring that developments remain financially attainable for economically disadvantaged and vulnerable populations. Innovative practices, which integrate green building standards and energy-efficient designs within affordable housing initiatives, illustrate that sustainability can harmoniously coexist with economic feasibility.

Public-Private Partnerships, as noted by Akinsulire et al. (2024), involve collaborative efforts between governmental entities and private enterprises to enhance the viability of sustainable housing initiatives, effectively mobilizing resources and expertise to surmount financial and regulatory obstacles. Such collaborations are vital for mitigating the initial financial burdens associated with sustainable construction practices, which may otherwise impede investment in affordable housing developments.

Social sustainability in housing is a multifaceted concept that emphasizes the quality of life within communities, focusing on social interactions, inclusivity, and community cohesion. It is an essential pillar of sustainable development, alongside environmental and economic sustainability. Social sustainability in housing according to Makalima (2024) creates environments that foster social relationships, provide psychological comfort, and enhance community building. This can be achieved through the integration of informal social spaces, prefabricated housing solutions, and attention to mass housing projects. Informal social spaces such as meeting places, religious sites, and areas for informal enterprises are crucial for enhancing social sustainability. These spaces according to Veluru and Karki (2023) promote social interactions and cohesion, contributing to the establishment of social capital within neighborhoods.

Ziaesaeidi and Farsangi, (2024) presents prefabricated housing as offering potential for social sustainability by being adaptable and accessible, encouraging interaction and participation among residents. This housing model can foster a sense of belonging and social cohesion, although it requires further research to fully understand its impact on social sustainability. Mass housing projects are described by Oksuz and Sari (2023) as housing units which prioritize economic efficiency, spatial diversity and which can lead to socially unsustainable environments.

Smets and van Lindert (2016) considers sustainable homes as ones that are: utilizing ecological low-energy and cost-effective building materials and technologies; resilient to potential natural disasters and climate impacts; connected to decent, safe, and affordable energy, water, sanitation, and recycling facilities; making the most efficient use of energy and water; having certain on-site renewable energy generation and water recycling capabilities; not polluting the environment and protected from external pollution; being suitably located in terms of jobs, shops, health and child-care facilities, schools, and other services; appropriately integrated into and bolstering the social, cultural, and economic fabric of the surrounding neighborhood and larger urban areas; and well-maintained, timely renovated and retrofitted.

There is no consensus in literature on an explicit metric to measure sustainable housing, though numerous approaches have been adopted across the globe. Galster and Ok Lee (2020) posits that the most important metrics must encompass energy efficiency, environmental impact, affordability, resilience to climate change, access to basic services, social economic integration and quality of life. Hristov and Chirico (2019) identified several Key Performance Indicators (KPI) for sustainable housing and proposed the following as key measures of sustainable housing, energy efficiency, indoor air quality, affordability, community integration, resilience to climate change, construction waste management, green space provision and water conservation. With Kenya's growing economy and one of the fastest-growing urbanization rates in the continent (4.3 percent year) and with about 27 percent of the population living in urban areas, the demand for sustainable housing has never been greater (GoK, 2018b; Kieti et al., 2020). Adamec et al. (2021) in a study on how to measure sustainable housing, presented five measures.

First, Energy Use Intensity (EUI): This metric quantifies the energy consumed per square foot per year, reflecting a building's operational efficiency. Sustainable housing aims for lower EUI through enhanced insulation, high-performance windows, and energy-efficient HVAC systems. Second, Embodied Carbon Footprint: This measures the greenhouse gas emissions associated with the entire lifecycle of building materials, from extraction to installation. Utilizing materials with low embodied carbon, such as wood or recycled products, is a priority in sustainable construction. Third, Water Use Intensity (WUI): This KPI assesses indoor water consumption, emphasizing the importance of efficient fixtures, rainwater harvesting, and greywater recycling to minimize usage. Fourth, Indoor Environmental Quality (IEQ): This Focuses on occupant health and comfort. IEQ includes metrics related to air quality, thermal comfort, and natural lighting. Sustainable designs enhance natural ventilation, reduce Volatile Organic Compounds (VOCs), and maximize daylight access. Fifth, Waste Diversion Rates: This metric evaluates the effectiveness of waste reduction and recycling efforts during construction and demolition, aiming to minimize landfill contributions.

2.3.2 Housing Policies and Legislations for Sustainability

An examination of creating more sustainable social housing in Serbia by Njegic (2022)

identified pertinent criteria for reviewing literature on sustainable social housing design. The criteria were systematically organized and interpreted to align with Serbia's specific context and needs. The study established that there was insufficient application of legislation on sustainability criteria in Serbia's social housing sector. They developed a conceptual multicriteria framework to enhance existing policies in designing and evaluating social housing settlements and buildings.

According to National Housing Corporation (2023), the National Housing Policy (2004, Revised 2016) provides that National and County Governments will establish a unified regulatory and institutional framework to improve cooperation, enforce compliance, and define industry standards. As a policy direction, the National and County Governments will continually examine construction rules and regulations to align with the changing construction environment, including the private sector and developing technologies. The Strategic Plan identifies Kenya's major housing policies and legislation to include among others: National Housing Policy (2004, Revised 2016), the Affordable Housing Programme (The Big Four Agenda, 2018 and The Bottom-Up Economic Transformation Agenda 2022), Kenya Vision 2030, the National Urban Development Policy (NUDP, 2016), and the Slum Upgrading Policy, The Constitution of Kenya (2010), The Housing Act CAP (117), Architects & Quantity Surveyors Act, Cap. 525, Community land Act No. 27 of 2016, Engineers Act, 2011, Environmental Management and Coordination Act (EMCA) No. 8 of 1999, National Construction Authority Act No. 41 of 2011, Physical Planning Act No. 6 of 1996, Survey Act Cap. 299, Water Act No. 43 of 2016, Lands Act No. 6 of 2012, Land Registration Act No. 3 of 2012, Urban Areas and Cities Act (2011, Amended 2019), Physical and Land Use Planning Act (2019), Building Code (1968, Revised 2024), Public-Private Partnerships Act (2021), and Kenya Mortgage Refinance Company Act (2018).

Government of Kenya (2016a), reports that the National Housing Policy (2004, Revised 2016) sought to improve access to housing by fostering employer-employee-facilitated housing partnerships. It encouraged mechanisms for employers to assist employees in purchasing homes through loans or mortgage facilitation. In 2004, the Civil Servants Housing Scheme Fund was established, with the goal of providing loan facilities to civil servants for the purchase or construction of residential homes, developing housing units for sale or rental to civil servants, and raising funds to carry out these objectives. By January

2016, this fund helped 3,002 civil servants. The 2016 revision of the National Housing Policy was necessitated by several circumstances.

First, constitutional alignment: After Kenya's Constitution was promulgated in 2010, which established the right to accessible and appropriate housing, the policy needed to be updated to reflect these constitutional obligations (United Nations Human Settlements Programme, n.d.). Second, it was intended to address the growing disparity between the demand and supply of affordable housing, emphasizing the need for novel approaches to overcome this gap. Third, Stakeholder Engagement: The revision process began in 2012 and included extensive consultations with housing sector stakeholders, concluding in a national symposium on June 26, 2013, at which the amended policy was ratified (GoK, 2016a). In a study by Bucha et al. (2020) policy gaps were identified in Sessional Paper No. 3 of 2016 that included difficulties accessing affordable housing finance due to high interest rates, stringent documentation requirements, and a lack of collateral.

The government has also struggled with outdated regulations, weak institutional frameworks, and limited support for housing programs. According to Omar (2018) corruption and mismanagement of resources have further impeded efforts, with funds often misappropriated, resulting in incomplete or substandard housing projects. While the housing policy emphasizes creating favorable conditions for public and private sector participation, these systemic challenges have limited its impact.

The Affordable Housing Programme (AHP) was launched in 2018 as a crucial pillar of Kenya's "Big Four Agenda" with the goal of addressing the housing gap by providing inexpensive and decent homes for poor and middle-income individuals. The program set huge targets, including delivering 500,000 affordable homes across 47 counties, lowering the cost of home ownership by 50%, and creating 300,000 new construction employment (GoK, 2016a). This target of affordable was revised to 1 million housing units by 2027 under the Bottom-Up Economic Transformation Agenda (BETA) of current Kenyan administration in 2022, inferring an ambitious plan to construct of 200,000 units every year. To facilitate the realization of the affordable housing programme and for better funding of the initiative, the parliament in 2024 enacted the Affordable Housing Act, establishing the affordable housing fund as a tax and the Affordable Housing Board (AHB) to oversight and

coordinate affordable housing development.

Kenya's Vision 2030 is a long-term development plan that aims to transform the country into a newly industrializing, middle-income nation with a good quality of life for all residents by 2030. The housing component of this vision is linked to the Social Pillar, which focuses on increasing the quality of life through several social sectors, including housing and urbanization (GoK, 2007). The main goals of Vision 2030 are to enhance housing production by supporting the construction of 200,000 dwelling units per year to meet the current housing gap and accommodate the expanding population. Second, improve urban planning and development: Prepare and implement strategic development and investment plans for six metropolitan regions (Nairobi, Mombasa, Kisumu-Kakamega, Nakuru-Eldoret, Wajir-Garissa-Mandera, and Kitui-Mwingi-Meru), as well as their spatial plans. Third, slum upgrading: Improve slum dwellers' living conditions by constructing physical and social infrastructure in slums and informal settlements in certain urban regions. Fourth, review and draft the National Urban Development Policy (NUDP), as well as implement the Urban Areas and Cities Act of 2011, to create a climate conducive to housing development. Fifth, promote the development of appropriate building materials and technologies to lower construction costs and make housing more affordable (GoK, 2007).

Kenya's National Urban Development Policy, which was revised in March 2016, provides a comprehensive framework for guiding sustainable urbanization and development throughout the country. Its principal purpose is to successfully manage urban growth, ensuring that cities contribute favorably to national development while also providing citizens with a high quality of life (GoK, 2016b). The NUDP's major aims are: First, support good urban government and management to increase openness, accountability, and public participation. Second, construct structures for robust economic growth and development in urban areas, including entrepreneurship and employment creation. Third, use spatial planning to foster sustainable urban growth, assuring ordered and well-planned urban places. Fourth, Infrastructure Development: Promote the development of requisite infrastructure and services in urban areas to support economic activities and improve living standards. Fifth, Promote Housing: Support the development of affordable housing of acceptable quality in urban areas to address housing shortages and improve living conditions. Sixth, Environmental Management: Promote urban environmental planning

and management, as well as climate change adaptation, to create resilient and sustainable urban environments. Seventh, Infrastructure development: Enhance the delivery of social infrastructure and services, including education, health, and recreational facilities, to meet the needs of urban populations (GoK, 2016b).

According to GoK (2016c) Kenya's National Slum Upgrading and Prevention Policy (NSUPP) establishes a comprehensive framework for improving living conditions in informal settlements by integrating them to formal urban setups as well as prevention of new slums. The policy prioritizes supporting secure land tenure, fostering in-situ upgrading, constructing social housing, and improving public facilities and infrastructure. Launched in 2011 and implemented in collaboration with the World Bank and other development partners, The Kenya Informal Settlements Improvement Project (KISIP targets the upgrading of informal settlements by providing basic services such as roads, drainage, water, sanitation, and street lighting, while also facilitating the regularization of land tenure (World Bank, 2019). The programme has encouraged participatory approach to settlement planning, where community engagement plays a central role in identifying priorities and shaping intervention strategies (UN-Habitat, 2020).

However, some studies focused on Kenya's urbanization and housing policies such as KISIP have noted that while the projects contribute to physical infrastructure improvements and enhanced service delivery, their long-term sustainability is influenced by factors such as policy coherence, institutional coordination, and the scalability of its interventions (Gulyani & Bassett, 2017). Furthermore, critiques have emerged around the limited integration of environmentally sustainable design practices within KISIP' s implementation framework, as well as concerns about the potential for gentrification and displacement if land regularization is not coupled with affordable housing measures (Lines & Makau, 2017). Despite these challenges the referenced policy programmes serve as a valuable case study for assessing the impact of housing policy and design approaches on urban and housing sustainability, particularly in low-income and informal settings.

In an evaluation of the Kenya Government housing policies and strategies for housing the urban poor in Kenya, Ondola et al. (2013) used quantitative survey study methodology, interviews and interview guides and observation to gather primary data. The results

showed that: housing has never been a primary area of government interest, the government does not drive and guide regional and local housing action, the government does not attempt to broaden focus on housing policy and integrate it with broader economic, social, and environmental goals, the government does not have a good policy/subsidy mix and balance, the government does not have effective implementation strategies, the Security of Land Tenure is not well promoted, there is a lack of affordable land and infrastructure, the housing finance system is inadequate, local building materials and technologies are not used, it does not support small-scale construction activities and contractors, the standards and legislation are inappropriate, communities do not participate adequately in low-cost housing development, research is inadequate, and lastly there is a lack of public/private partnership on low-cost housing development.

In a study of Housing Policies and Programmes in Nigeria, Waziri and Roosli (2013) observed that through a variety of policies and programs, the Nigerian government has been working together to improve housing delivery, first as a supplier in the 1970s and 1980s and more recently as a facilitator and enabler. However, in light of the nation's growing housing needs, no significant progress has been made to date. Using comprehensive literature review of Nigeria's current housing policies and programs the authors sought to assess the degree of implementation, adaptation, and compliance. The study opined that housing policies should have broad coverage, should be sustainable in terms of implementation and inclusivity and more so they underscore that public participation and consultation in housing policy formation was imperative in ensuring the policies accommodate cultural issues and overall housing norms.

The American Housing Survey Report (USA, 2007)) unearthed an acute housing shortage with evidence pointing at a critical housing need that had increased dramatically between 2003 and 2005, from 14.3 to 17.5 million. To address the housing crisis, the United States of America (USA) implemented measures to address the urgent housing needs, such as implementing expedited permitting and reviewing housing policies, creating inclusionary zoning requirements or incentives that capitalize on employers' dedication to providing workers with affordable housing, maintaining affordable rental properties, and increasing home ownership education and counseling, among other measures.

According to the National Housing Corporation (2023), the goal of the National Housing Policy was to address the country's worsening housing circumstances and close the housing stock gap caused by demand that is significantly higher than supply, especially in metropolitan areas. The population boom, fast urbanization, pervasive poverty, and rising housing costs have all contributed to this predicament. Overcrowding, slums, and the growth of informal settlements, particularly in peri-urban areas, are signs of the housing crisis. The lack of basic utilities like clean drinking water and the poor condition of the housing fabric are two ways that the deficit shows up in rural areas. The goal of the housing policy then was to make housing, essential services, and infrastructure for a healthy lifestyle accessible to the impoverished.

Sessional paper No.3 of 2016 provided key policy directions for urban housing. It emphasized rental and rent-to-own housing options, encouraged the use of affordable building materials and innovative construction technologies, and highlighted the need for sustainable urban renewal. However, the government's efforts to implement housing policies have often been marred by limited political commitment, inefficiencies in bureaucracy, and insufficient resources. The ability to adequately fund social housing and related infrastructure has exacerbated housing challenges, leaving large segments of the population dependent on informal settlements. Furthermore, limited government promotion of research and innovation in low-cost construction technologies has hindered attempts to reduce building costs and improve housing availability (Agayi & Karakayaci, 2019).

2.3.3 Housing Approaches for Sustainability

Kenya has implemented various housing programs to address its growing housing challenges, as suggested in Strategic Plan 2023-2027 (National Housing Corporation 2023). These initiatives include the Kenya Slum Upgrading Programme (KENSUP), Housing Sector Incentives, Housing Infrastructure Development Programme, and the Civil Servants Housing Scheme Fund. KENSUP, launched in 2000s through an MoU between the Kenyan government and UN-HABITAT, aimed to rebuild slums and informal settlements. In addition, the Plan covers the following existing housing approaches; Public Housing Development, Affordable Housing Programme (AHP), Private Sector Housing

Development, Social Housing and Rental Housing, Cooperatives and Community-Led Housing, Self-Built and Incremental Housing, Green and Sustainable Housing and Institutional and Employer-Assisted Housing. A brief account of these housing approaches is provided here after.

Public housing is a government project that aims to provide low-income individuals and families with inexpensive housing. Vale (2011) observes that these programs exist all throughout the world, with laws that differ by country and location. Affordable Housing Programme. The World Bank (2020) report notes that in Kenya, private sector housing development supplements government attempts to fulfill the country's housing demand. The sector has a substantial impact on urban expansion, real estate growth, and economic development. Private developers, financial institutions, and investors play critical roles in assuring housing availability, particularly for middle and upper-income workers. Social and rental housing are important components of the housing industry because they provide affordable housing options for low- and middle-income people. According to GoK (2018a), social housing is government-subsidized housing for needy people, whereas rental housing encompasses both private and public rental units that cater to a wide range of income levels. Recent Government initiatives tend to highlight the relevance of rental and social housing. The Housing Act and the National Housing Policy highlight the importance of providing affordable rental apartments to meet the needs of rising urban populations.

Cooperatives and community-led housing initiatives provide an alternative approach to housing development, emphasizing collective ownership, affordability, and participatory decision-making (World Bank, 2020). These models empower communities to take charge of their housing needs, reducing dependency on government and private developers. In Kenya, housing cooperatives have played a significant role in providing affordable homes, particularly through Savings and Credit Cooperative Organizations (SACCOs). The government has recognized cooperative housing as a viable solution under the National Housing Policy, promoting financial and technical support for community-led initiatives (GoK, 2018a).

Self-built and incremental housing are important housing approaches that enable people and families to build homes progressively, based on their financial resources. This strategy

addresses Kenya's housing need in an affordable and flexible manner, minimizing dependency on large-scale developers (GoK, 2018a). Many families build their homes in stages, prioritizing vital buildings before expanding based on economic capabilities. The government and international organizations, such as UN-HABITAT, have recognized incremental housing as a feasible strategy to affordable housing, calling for supportive policies and infrastructure development (World Bank, 2020). Institutional and employer-assisted housing models are described by International Finance Corporation (2021) as housing approaches that involve direct participation by institutions and employers in providing or facilitating housing solutions for their workforce. Institutional and employer-assisted housing in Kenya dates back to the colonial period when government institutions and private companies provided housing for employees, particularly in urban centers and industrial zones (GoK, 2018a). Over time, formal employer-supported housing schemes have declined due to economic constraints and shifting employment trends.

Anderson and Mwelu (2013) provided a comprehensive evaluation of Kenya's two major slum upgrading initiatives: the Kenya Slum Upgrading Programme (KENSUP) and the Kenya Informal Settlements Improvement Programme (KISIP). These programs aimed to improve living conditions in informal settlements through infrastructure development, housing improvements, and community engagement and achieving Sustainable Development Goal 7.

Similarly, Burugu (2015) analyzed the Korogocho Slum Upgrading Programme, which focused on improving physical, economic, and social conditions in slums while securing land tenure. However, Burugu (2015) noted that these programmes often lack innovative design strategies, exposing a conceptual gap. Wachira (2014) explored housing approaches in Nairobi County and identified strategies such as implementing county housing policies, slum upgrading, and promoting low-cost housing through sector incentives. The study also emphasized the adoption of appropriate building materials and technologies and active stakeholder involvement in improving housing outcomes.

Muturi (2013) examined employer assisted housing programs, particularly the Civil Servants Housing Scheme Fund, which provided low-interest loans to civil servants to improve accessibility and affordability. Supported by Sessional Paper No. 3 of 2004, this

program helped civil servants acquire housing but lacked a focus on sustainability. While these strategies have significantly contributed to addressing housing challenges, they fall short of ensuring long-term sustainability. This shortfall highlights the need for innovative approaches to bridge the conceptual gaps in housing programs.

Globally, other nations provide insights into successful housing strategies that Kenya could consider. In Singapore, the Central Provident Fund (CPF), established in 1955, has evolved into a comprehensive social security system encompassing homeownership, healthcare, and retirement planning. Koh and Mitchell (2010) acknowledged the CPF for enabling the Housing and Development Board (HDB) to deliver clean, green, and socially conscious housing solutions. Despite its success, Koh noted challenges in applying the CPF model in Kenya due to contextual differences. Similarly, Vienna's Sustainable Urban Renewal Program emphasizes community participation in redevelopment projects. Hatz (2008) highlighted Vienna's "soft urban renewal" approach, where citizen consultations are prioritized before redevelopment decisions. However, Hatz also identified a gap in the program's ability to ensure the long-term sustainability of housing units.

Kenya's housing programs have made notable progress in addressing urban housing issues and improving affordability. Programs like KENSUP and the Civil Servants Housing Scheme fund have enhanced access to housing for specific groups, such as slum dwellers and civil servants. However, the lack of innovative design and sustainability measures to these programs presents ongoing challenges. Global models like Singapore's CPF and Vienna's Urban Renewal efforts offer valuable lessons, but they require significant adaptation to Kenya's socio-economic context. Addressing these gaps will demand integrating innovative design, emphasizing sustainability, and fostering collaboration among housing stakeholders. This multi-pronged approach is essential for ensuring long-term, impactful solutions to Kenya's housing challenges.

2.3.4 Housing Design Innovations for Sustainability

The first innovative design strategy to be considered was *modular construction.* Musa et al. (2016) defines modular construction as a construction process where building components or modules with the same design and standard are produced in a manufacturing plant and then transported and installed to become a building. Musa et al. (2016) observes that

modular construction provides efficiency and speed, quality control, cost savings, sustainability, flexibility and scalability, safety, customization and reduced disruption to mention but a few. An in-depth review of empirical studies on modular construction is presented here after.

The idea of modular construction is one that has the potential to completely transform the building sector as observed by (Sajid et al., 2024). While noting that many academic researchers have advanced knowledge of modular construction, Sajid et al. (2024) contents that there is still a dearth of comprehensive reviews of literature that systematically record the effects of applying modular construction on mitigating climate change. The researchers carried out a systematic literature review of the relevant literature that was obtained from the Scopus repository. The review was carried out on 31 shortlisted publications that were published between 2010 and 2023 using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. The study findings show that modular construction can lessen the effects of climate change by lowering greenhouse gas emissions, promoting a circular economy, encouraging energy efficiency, and encouraging resourceful land use and management in the construction industry.

The study concludes that among its other positive attributes, the sustainability of modular construction has attracted more attention and praise from the scientific community, particularly when it comes to measures to mitigate climate change. The reference to climate change as the outcome variable in the study gives rise to a conceptual gap.

In order to create sustainable housing projects, Romero et al. (2023) evaluated modular construction methods produced with low environmental effect building materials. The study used the Skylark 250 model as the chassis for the building, applying the clay plaster by hand and the wheat straw using a blowing method. For this solution, thermal transmittance, energy demand, environmental impact, and economic analysis were all assessed. Block production using subtractive manufacturing processes was demonstrated to be extremely accurate and productive, greatly cutting down on building time. In addition, the use of clay plaster, which lowers energy consumption for heating and cooling, in conjunction with materials like wheat straw as thermal insulation has proven to be highly successful in achieving the best possible indoor thermal environment. The study's established that

modular housing may fulfill the Net Zero Homes (NZHs) challenge with an energy consumption of only 55 (kWh/m2/year) when combined with solar panels. The suggested approach is an appealing alternative for the housing market because it is 29% less expensive and takes 44% less time to build than conventional construction methods. Romero et al. (2023) deduced that there is a great deal of opportunity to increase efficiency and sustainability in the construction sector by using the Skylark 250 model while building modular homes.

Rakesh Sai Kumar Mandala and Ramappa Ramesh Nayaka (2023) conducted a study on the benefits of modern construction techniques for sustainable housing. They used a systematic literature review to evaluate the latest scientific data on the topic. They found that interlocking systems and prefabrication processes, particularly Light Gauge Framing System (LGSF) construction, can help the construction industry grow. Light Gauge Framing System construction saves money and time on material handling, shuttering labor, and roofing systems. Sandwich panels are cost-effective, offer superior insulation, and can be constructed quickly. Modular buildings have become dominant in the last decade due to their numerous benefits.

Nazir et al. (2020) conducted a comparative analysis of modular and traditional UK housing construction strategies to determine if changing construction processes could help the UK's domestic housing crisis. The study used a two-stage methodology, focusing on housing in the UK, housing crisis, building expenses, conventional construction, modular construction, masonry, and sustainability. The research found that using sustainable building materials and techniques, integrating eco features like solar panels, ground source heating, and rainwater collection systems, and using modular construction resulted in lower operating costs and increased environmental sustainability. The study also found that modular construction is more effective than traditional brick-laying building in terms of quality, cost, and time, with a 22% lower cost.

The second innovative design strategy was *sustainable building materials.* Sustainable building materials are vital components of construction that minimize their impact on the planet and prioritize environmental responsibility (Suryandari, 2019). These materials are sustainable because they are eco-friendly and renewable, have low environmental impact,

are energy efficient, durable, and can be locally sourced.

Bredenoord (2017) suggests that conventional building materials like iron, cement, and concrete are not environmentally friendly and contribute to significant greenhouse gas emissions. Sustainable building materials include bamboo, recycled steel, reclaimed wood, cork, and straw bales. Bamboo is renewable, strong, and flexible, while recycled steel reduces carbon footprints. Reclaimed wood offers a modern construction style, cork absorbs sound and acts as insulation, and straw bales are thermally insulation rich. Integrating modern technologies with local building traditions is crucial for sustainable building practices.

The study by Gan et al. (2017) explores the sustainability of affordable housing in emerging nations like China, where rapid urbanization poses a significant challenge. The research uses a hybrid methodology to create a list of sustainability performance metrics for affordable housing, focusing on cost and time. The study identifies 24 Key Performance Indicators (KPIs) for sustainable affordable housing, including energy efficiency, indoor air quality, affordability, community integration, climate change resilience, construction waste management, green space provision, and water conservation. The study's location in China highlights a contextual gap.

Marzouk et al. (2016) studied the framework for sustainable low-income housing projects in Egypt using building information modeling. They found that the construction of affordable housing complexes in developing nations benefits the underprivileged population but has high Life Cycle Costs (LCC), affecting their economic sustainability. To reduce LCC and maximize Leadership in Energy and Environmental Design (LEED) materials credits, a framework integrating computer simulation, optimization, and system dynamics with BIM was established. The framework helps estimate project duration and material system options, focusing on the LEED rating system. The study highlights the importance of sustainable building materials during construction for a sustainable building.

The third innovative design strategy was *smart home technology.* Tirado Herrero et al. (2018) considers a smart home as a configuration of state-of-the-art technology that smoothly automates and simplifies household tasks. Smart home networked gadgets are their central component. These devices (sometimes comprising of smart lighting, smart

thermostats, smart security cameras and smart appliances) speak to one another, blending their conveniences into a beautiful symphony. In addition, a smart home is a place of living with a communications network connecting sensors, household appliances, and other gadgets that can be accessed, operated, or monitored from a distance and that offer services tailored to the needs of their occupants (Balta-Ozkan et al., 2014).

Moghayedi and Awuzie (2023) studied the sustainability of Sustainable, Innovative, Affordable Housing (SIAH) -Livable in South Africa. They used innovative technologies, materials, and techniques to design affordable housing. The study found that SIAH-Livable significantly reduced water and energy consumption, embodied energy levels, and embodied energy levels while remaining within the government's cost range.

Moghayedi and Awuzie (2023) study identifies four factors for achieving Sustainable Housing Architecture (SIAH): housing design, home element, production technique, and technology. They identified 127 Critical Success Factors (CSFs) aligned with these features, including energy- efficient systems, tenure security, indoor environment, sustainable housing costs, water-efficient systems, and SIAH CSF framework. Sustainable design techniques enhance housing sustainability and affordability.

Adeyeye (2024) explored the impact of homeowner opinions on the adoption of smart technologies in their homes. The research uses a hermeneutic research approach and a conceptual framework from the United Theory of Acceptance of Technology and the Technology Acceptance Model. The study used a survey, focus groups, interviews, and literature review to assess the quality of housing. The results showed that homeowners are more likely to adopt smart home technology if it offers benefits such as utility efficiencies, convenience, information, and entertainment services. This study aims to close the theory-to-practice gap in smart home performance monitoring.

Aggar et al. (2023) studied the impact of Smart Home technology on older people's quality of life. The study used the Personal Wellbeing Index (PWI) to assess how technology affected subjective quality of life. The study involved 60 participants aged 68 to 90, who completed a 12- week government-funded Smart Home program. The results showed that 48.3% of participants were living alone at study time. After using a smart home, the participants' quality of life significantly improved, with significant improvements in

"achieving in life" and "future security." The study concluded that Smart Home technology can enhance elderly people's sense of accomplishment and security for the future.

Tetteh and Amponsah (2020) study on sustainable adoption of smart homes in Sub-Saharan Africa (SSA) found that these homes enhance comfort, diversify energy sources, promote inclusive housing, and promote environmental cleanliness. The study used literature review and PRISMA guidelines to assess the adoption of smart homes but emphasized the need for a methodological gap in the literature review approach.

The fourth innovative design strategy was *passive design.* Passive solar design strategies are a sustainable approach that reduces energy consumption and artificial lighting in buildings. They can lower operating costs, improve reputation, and minimize environmental impact. A study by Mari et al. (2020) validated the use of green passive techniques in low-income community groups. The study used energy analysis calculations for a modest residential home in Ajloun, Jordan, comparing Jordanian Energy Codes, local practices, and the Green Affordable Homes project. Results showed a 70% reduction in energy loads compared to traditional methods. Alshorman et al. (2018) validated the LEED-based Jordanian green building model, earning 69 out of 110 points and earning the gold class in the LEED nominal classification. Fernandez-Antolin et al. (2019) studied passive design strategies for low-income affordable housing in San Pedro Sula, Honduras. They found that these strategies, including orientation, shading, natural ventilation, daylight, and open spaces, significantly reduced electric utilities by 44%, resulting in a significant reduction in housing expenses for low-income families.

Ali and Alzu'bi (2017) conducted a study on affordable housing projects in Jordan to create a sustainable model. They used a mixed design approach and cross-sectional design strategy to assess environmental aspects. The study found that the proposed passive solar design strategy can save up to 50.4% of yearly energy consumption and reduce water use by 43%. The research highlights the need for more attention to environmental and sustainability issues in Jordan's housing projects. The study's focus on Jordan, posits a contextual gap.

2.4 Research Gaps

While the above reviewed studies provide empirical evidence of the nexus between; existing approaches to housing, national housing policy frameworks and legislation and

innovative design strategies in the form of modular construction, sustainable materials, smart homes technology and passive designs and performance of sustainable housing, it is imperative to identify related research gaps. Table 2.1 below gives a synopsis of the conceptual gaps, contextual gaps, methodological gaps amongst other research gaps.

Table 2.1: Summary of Literature Review and Research Gaps

Author/s	Research Topic	Research Finding	Research Gap	Focus of Current Study
Sajid et al. (2024)	Climate change mitigation through modular construction.	Modular construction can mitigate climate change by reducing greenhouse gas emissions, promoting a circular economy, enhancing energy efficiency, and promoting resourceful land use in the construction industry.	The study related modular construction to climate change, resulting in a conceptual gap.	The current study sought to relate innovative design strategies to sustainability of housing
Romero et al. (2023)	Assessment of Modular Construction System Made with Low Environmental Impact Construction Materials for Achieving Sustainability of housing Projects.	The study established that modular housing may fulfill the Net Zero Homes (NZHs) challenge with an energy consumption of only 55 (kWh/m2/year) when combined with solar panels.	The study picked on only one element of innovative design strategies in terms of modular construction system, resulting in a conceptual gap.	The current study examined the combined effect of existing housing programmes, innovative design strategies and policy and practice
Rakesh Sai Kumar Mandala and R. Ramesh Nayaka (2023)	A state of art review on time, cost and sustainable benefits of modern construction techniques for affordable housing.	The Light Gauge Framing System construction offers numerous benefits over traditional methods in the contemporary construction industry for mass housing.	The study focused on the benefits of modern construction techniques for affordable housing. This implies a concept variation.	The current study sought to link existing housing programmes, innovative design strategies and policy and practice to sustainability of housing.

Table 2.2: Summary of Literature Review and Research Gaps (Cont'd)

Nazir et al. (2020)	Comparison of modular and traditional UK housing construction: A bibliometric analysis.	This study compares the two and finds that modular construction is more effective in comparison to the traditional brick laying building approach, particularly in terms of quality, cost, and time and hence all aspects that are presently impeding the supply side delivery of houses in the United Kingdom.	The research locale being the UK leads to a contextual gap.	The study at hand was undertaken in Kenya
Generalova et al. (2016)	Modular buildings in modern construction	The utilization of modular units results in lower construction costs, even for the construction of tall buildings.	The study comprised a review of related literature, implying a methodology gap exist.	The current study used exploratory approaches and employed the use of interviews, Focus Group Discussions and field visits
Bredenoord (2017)	Sustainable Building Materials for Low-cost Housing and the Challenges Facing their Technological Developments: Examples and Lessons Regarding Bamboo, Earth-Block Technologies, Building Blocks of Recycled Materials, and Improved Concrete Panels.	It was determined that using locally appropriate and sustainable building materials like adobe, bamboo, wood, and compressed earth blocks can be rather promising and sustainable. It is necessary to integrate modern low-tech and low-cost technologies with local building traditions.	The study used one component of innovative design strategies, sustainable building materials and hence a conceptual gap.	The current study collated all the components of innovative housing design strategies

2.5 Visualization Frameworks

The study was guided by two frameworks for visualizing relationships amongst the variables: a problem tree and a conceptual framework. While the problem tree portrays the network and/or process of influence, the conceptual framework portrays the researcher's cause-and-effect construction. Both visualizations aid the researcher in quantitative and qualitative data analyses.

2.5.1 Problem Tree

From the literature reviewed, a problem tree in Figure 2.1 below was synthesized. The tree presents the focal problem in the study as sustainability of housing. Accordingly, the problem emanates from existing housing policies, existing legislation, existing housing approaches and absence of innovative design strategies. Consequences of the research problem include environmental degradation, social fragmentation and economic unsustainability.

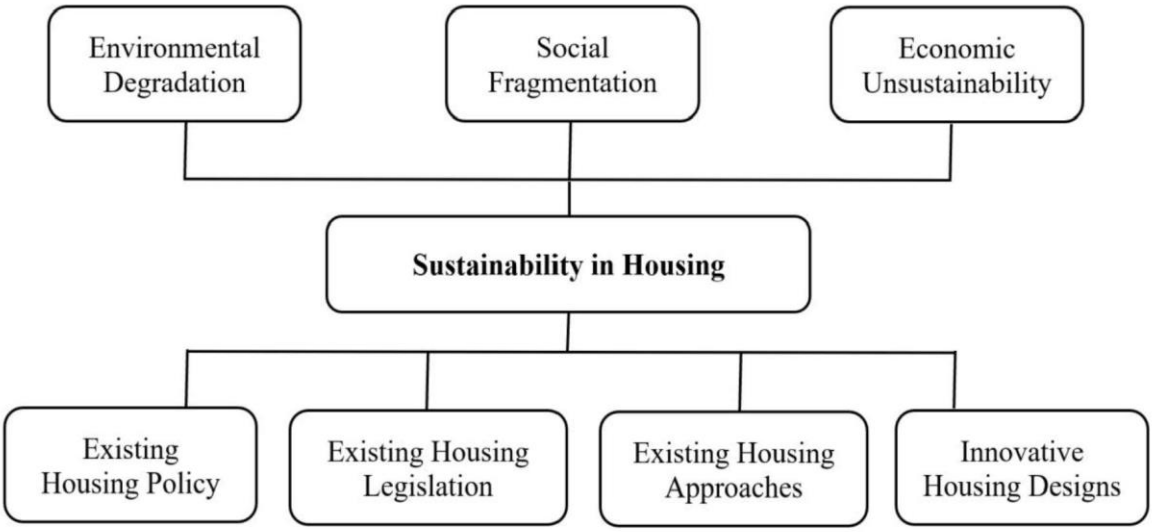

Figure 2.1: Problem Tree

2.5.2 Conceptual Framework

From the literature reviewed, a conceptual framework for this study was constructed as shown in Figure 2.2 to situate the research within existing theoretical and empirical work. The

explanatory variables comprise adequacy of the existing housing policies and legislations, quality of the existing approaches to housing and innovativeness of housing designs (modular construction, sustainable materials, smart homes technology and passive designs). As Figure 2.2 depicts, the explanatory variables are influencers of sustainability of housing in Kenya. The conceptual framework is more structured than the problem tree, and was the basis for formulating the data collection tools in Appendix III, IV and V.

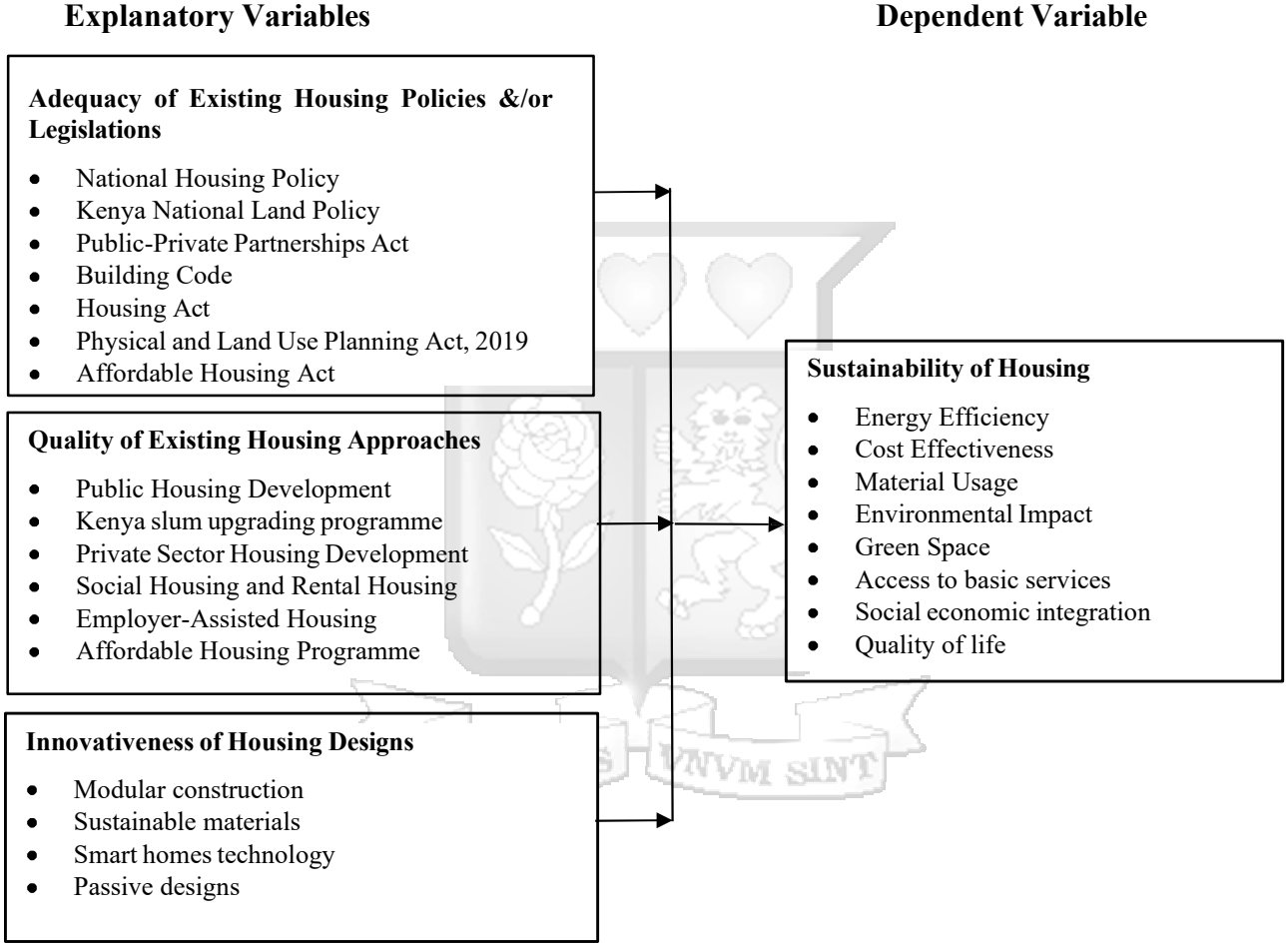

Figure 2.2: Conceptual Framework

In Figure 2.2, the arrows imply the construed direction of influences and were considered in the quantitative and quantitative research methods adopted in the study. The relationships portrayed in the conceptual framework were used to formulate operational definitions of the study variables and the data collection instruments, as explained later in Sections 3.6 and 3.7. respectively.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methods, techniques and procedures that were adopted in this study. They were used to assess the level of housing sustainability, appraise the existing housing policies, legislations, approaches and design innovations and the extent to which they have contributed to sustainability of housing in Kenya. The chapter covers research philosophy, research design, population and sampling, data collection instruments, data collection procedures, data analysis, research quality and ethical considerations.

3.2 Research Philosophy

Research philosophy refers to a set of beliefs, fundamental presumptions, and principles that underpin and guide research in a field of study (Davidavičienė, 2018). Research philosophy asks the questions, what is reality? How do we know what we know? Research paradigm on the other hand is the overarching framework within which a research philosophy performs. Park et al. (2020) adds that a research paradigm is guided by the following fundamental components: methodology axiology (the role and values of the research process), ontology (how reality is viewed), epistemology (how the nature of knowledge is conceived), and rigor (the standards used to justify the quality of research in the paradigm).

This study employed pragmatism research philosophy. Pragmatism is a philosophical stand that views the meaning and truth of ideas or theories in terms of their practical consequences and applications (Mukumbang, 2023). Pragmatism rejects the notion of absolute truths as propagated by positivist philosophy, asserting that truths are provisional and subject to change based on new experiences and information. Pragmatism instead emphasizes that the meaning and truth of concepts are determined by their observable practical effects. This philosophy further holds that knowledge is rooted in experience and is validated through active problem-solving and adaptation. Pragmatism was preferred because of its ability to underpin the use of mixed methods used in this study. Johnson (2017) adds that this approach emphasizes the practical application of research methods to address specific questions, allowing the study to combine qualitative and quantitative techniques based on the most effective approach in solving the problem at hand. Pragmatism prioritizes the research question over strict adherence to a single methodological paradigm, enabling a flexible and outcome-oriented approach. This was

in tandem with the goal of the current study which was to make observations and tap key housing stakeholders' experiential knowledge on existing housing related policies, legislations, approaches, design innovations and the extent to which they have influenced sustainability of housing in Kenya.

3.3 Research Design

Research design is a masterplan or framework within which researchers collect and analyze data (Bryman, 2012 & Plonsky, 2017). According to Bloomfield and Fisher (2019) the research design explains the procedures used in data collection, processing, and analysis as well as the assessment of the study variables. This study adopted a survey research design with a case study element. The survey component was the cross-section of ongoing housing projects, plus the key informants from various organizations in the housing sector provided data, while the study case is the public housing sector of Kenya. Additionally, the study employed a mixed-methods technique in the data collection and analysis, to comprehensively address the qualitative and quantitative aspects of sustainability of housing in Kenya. Therefore, the study adopted a mix of research designs (survey plus case study) and a mix of research methods (quantitative and qualitative; observation checklist, questionnaire and focus group discussion), as amplified later. This was because neither of the research designs nor research methods would alone adequately address the complex research question within the time available for the research work.

3.4 Data Collection Methods

In this study, data collection adopted a triangulation approach for practical reasons. The data collection methods were Site Visit Observation, Survey Questionnaire and Focus Group Discussion, whose tools are shown in Appendices III, IV and V, respectively. In view of the complexity of the subject area and the time available for fieldwork, none of the methods would alone give adequate data to address the research question. All the three methods were applied simultaneously because they focused on different albeit related aspects of housing sustainability in Kenya. While the Site Observation Checklist sought the level of housing sustainability achieved in selected ongoing public housing projects, the Survey Questionnaire sought respondents' views on the extent to which the sustainability determinant factors have so far caused housing sustainability achievement in Kenya. Finally, the Focus Group Discussion

Guide (FGD) sought leaders' and scholars' views on sustainability achievement and strategies for enhancing it at the macro, sectoral, industry and national levels.

3.5 Population and Sampling

Kothari (2017) defines the target population as a group of people or objects that have a common attribute or set of characteristics. This trait is shared by the majority of people in the population. The population of interest to this study was drawn from a list of key housing stakeholders in Kenya developed by the Housing Resource Centre Department of National Housing Corporation and is summarized in Table 3.1. This study collected data from this target population which included government agencies like Ministry of Lands, Public Works, Housing & Urban Development, county governments, developers, contractors, professionals, financial institutions, and civil and non-governmental organizations (NGOs). The study further engaged subject matter experts in academia, housing and urban planning and sustainability to offer insights into the effectiveness of existing policies, legislations, approaches and adoption of design innovations in housing in Kenya. Given the broadness of stakeholders in the housing sector, the target population size was considered infinite.

While the unit of analysis was the entire public housing sector in Kenya, there were three units of observation: project, respondent and group. For the site visit observations, the unit of observation was the public housing project, while for the survey questionnaire the unit of observation was the respondent. And for FGD, the unit of observation, the unit of observation was the group. Only one focus group discussion was conducted, as shown in Appendix VI.

The sample design defines the framework under which research is conducted. It serves as a guide for gathering, calculating, and analyzing data in accordance with the research objectives or research questions (Kothari, 2017). The process of selecting a subset of individuals or items from a larger population to make inferences about that population is known as sampling technique (Rahman et al., 2022). The study employed a non-probability sampling technique and in particular purposive sampling. This technique allowed the researcher to comprise key informants from select organizations involved in decision making, policy and practice of housing development as presented in Table 3.1. Because of the infinite population size, the study applied the Cochran's formula for sample size determination. Cochran's formula was expressed as follows:

$$n_0 = \frac{Z^2 p(1-p)}{e^2}$$

where:

- n_0 is the required sample size,
- Z is the z-score corresponding to the desired confidence level (e.g., 1.96 for a 95% confidence level),
- p is the estimated proportion of the population with the characteristic of interest (typically 0.5 when unknown to maximize variability),
- e is the margin of error (e.g., 0.05 for a 5% margin of error) (Cochran, 1977).

$$n0 = \frac{1.96^2 * 0.5\ (1-0.5)}{0.05} = 384.16 \approx 385.$$

Table 3.1: Sample Size

Sn.	Organization	Sample Size
1	Kenya Green Building Society (KGBS)	10
2	Kenya Association of Manufacturers (KAM)	10
3	Ministry of Lands, Public Works, Housing and Development	10
4	Ministry of Water and Sanitation	10
5	Kenya Bankers Association	10
6	Ministry of National Treasury and Planning	10
7	Kenya National Innovation Agency	10
8	Ministry of Environment, Climate Change and Forestry	10
9	United Nations- UNEP/UN-Habitat	10
10	Kenya Property Development Association (KPDA)	10
11	Kenya Private Sector Alliance (KEPSA)	10
12	National Environmental Management Authority (NEMA)	10
13	Council of Governors (CoG)	10
14	Kenya Federation of Master Builders (KFMB)	10
15	Kenya Building and Civil Engineering Contractors (KABCEC)	10
16	Roads and Civil Engineering Contractors Association (RACECA)	10
17	Kenya Mortgage Refinancing Corporation (KMRC)	10
18	Affordable Housing Board (AHB)	10
19	Housing NGOs and Community Based Organizations (HNCBO)	10
20	Energy and Petroleum Regulatory Authority (EPRA)	10
21	Law Society of Kenya (LSK)	10
22	Kenya Institute of Public Policy and Research Analysis (KIPPRA)	10
23	Board of Registration of Architects and Quantity Surveyors	10
24	Engineers Board of Kenya (EBK)	10
25	Institute of Surveyors of Kenya (ISK)	10
26	Institution of Engineers of Kenya (IEK)	10
27	Institution of Quantity Surveyors of Kenya (IQSK)	10
28	Institute of Designers of Kenya (IDK)	10
29	Town and County Planners Association of Kenya (TCPAK)	10
30	Architectural Association of Kenya (AAK)	10
31	World Bank and International Finance Corporation (IFC)	5
32	Kenya Revenue Authority (KRA)	10
33	The Kenya Alliance of Resident Associations (KARA)	10
34	African Development Bank (AFDB)	10
35	National Housing Corporation (NHC)	10
36	National Construction Authority (NCA)	10
37	National Industrial Training Authority (NITA)	10
38	Kenya Engineering Technology Registration Board (KETRB)	10
39	Commission for University Education (CUE)	10
	Total	385

Source: NHC Housing Resource Centre (2024)

The study then applied proportionate sampling, in drawing 10 respondents from each of the 39

organizations to arrive at an even distribution of the stakeholders as displayed in Table 3.1. This sampling approach was consistent with that applied in studies by Parrilli et al. (2020) and Criscuolo et al. (2017) and therefore complied with criterion related validity.

3.6 Operationalization of Variables

From the Conceptual Framework in Section 2.5 earlier, the study variables were operationalized to specify their conceptual definitions, common surrogates, and measurement criteria/units, as shown on Table 3.1. Additionally, the supporting general theories and previous research works which were amplified in the review of related literature are given.

Table 3.2: Operationalization of Variables

Variables	Variable Definition	Supporting Theories	Measures & Units	Authors
Adequacy of Existing Housing Policies and/or Legislations	This encompasses a range of policies, laws, and regulations applied by governments and organizations to address housing challenges, in a bid to ensure that all individuals have access to safe, affordable, and adequate housing. They are interrelated in principle but different in operation. For this reason, the researcher handled them separately in the research questionnaire (Appendix IV) but handled them jointly in the FGD Guide (Appendix V).	Gentrification Theory	National Housing Policy Affordable Housing Programme Public-Private Partnerships Building Code Housing Act Likert scale of 1-5 (in questionnaire) & respondents' themes and sentiments (in the FGD)	Bucha et al. (2020) Njegic (2022) Ondola et al. (2013) NHC (2023) GoK (2016a) GoK (2016b)
Quality of Existing Housing Approaches	The prevalent strategies to housing	Gentrification Theory	Public Housing Development Kenya Slum Upgrading Programme Private Sector Housing Development Social Housing and Rental Housing, Employer-Assisted Housing. Likert scale of 1-5 (in questionnaire) & respondents' themes and sentiments (in the FGD)	NHC (2023) GoK (2018a) World Bank (2020) The Sessional Paper No. 3 of 2016

Innovativeness of Housing Designs; Modular construction, Sustainable Materials, Smart Homes Technology, Passive Designs,	**Modular construction** involves producing identical building components in a manufacturing plant, transporting and installing them to create a building.	Ecological Modernization Theory	Reduced wastage Quality control Time efficiency Flexibility Scalability Safety	Musa et al. (2014) Sajid et al. (2024) Romero et al. (2023) Mandala and Nayaka (2023)
	Sustainable Building Materials are eco-friendly options that minimize their environmental impact and conserve natural resources.	Innovation Diffusion Theory	Durability Recyclability Locally sourced material Affordability Resilience to climate change Construction waste management	Bredenoord (2017) Gan et al. (2017) Ugochukwu and Chioma (2015) Marzouk et al. (2016)
	A smart home is a network of connected appliances that track energy consumption and the energy capacity of smart meters.	Ecological Modernization Theory	Automated Systems Artificial intelligence Renewable Energy Sources Smart lighting Smart thermostats Smart security cameras Smart appliances	Alkatheiri et al. (2021) Moghayedi et al. (2023) Adeyeye (2024) Aggar et al. (2022) Tetteh and Amponsah (2020)
	Passive solar design strategy is an approach that allows buildings to harness natural sunlight and heat, reducing the need for artificial lighting and energy consumption significantly.	Innovation Diffusion Theory	Natural Ventilation Thermal Insulation Building Layout Air-tightness Infiltration.	Adabre et al., (2020) Zancanella et al. (2018) Mari et al. (2020) Alshorman et al. (2017) Fernandez-Antolin et al. (2019) Ali and Alzu'bi (2017)
			Likert scale of 1-5 (in questionnaire) & respondents' themes and sentiments (in the FGD)	

Sustainability of Housing	Refers to individual or groupings of self-sufficient "green buildings," or residential practices that are both environmentally and socially beneficial and incorporated into larger settlement systems	Gentrification Theory	Energy Efficiency Cost Effectiveness Material Usage Environmental Impact Green Space Access to basic services Social economic integration Quality of life A continuous scale of 0 – 25, derived from a dichotomy of YES (1) & NO (0) in each of the 25 indicators in the Observation Checklist; and an ordinal scale of 0 -10 in the FGD.	Adetooto et al. (2022) Haidar and Bahammam (2021) UN-Habitat (2016) Galster and Lee (2021)

3.7 Data Collection Instruments

Data collection is the practice of acquiring empirical information to address research questions and provide fresh perspectives on a circumstance (Taherdoost, 2021). As stated before, the study collected primary data using three instruments: Observation Checklist (Appendix III), Questionnaire (Appendix IV), and Focus Group Discussion (FGD) Guide (Appendix V). The researcher considered the methods to be synergistic, and therefore the data collection exercise was conducted simultaneously using three groups of research assistants. While the FGD guide facilitated gathering of comprehensive information allowing participants to share their experiences, thoughts, and sentiments in depth - the Site Visit Observation Checklist aided the researcher to concentrate on specific aspects of sustainability achievement at project level, and identifying incidence of noncompliance in ongoing project sites. Also, the questionnaire came in equally handy. As highlighted by Kuphanga (2023), it enabled the researcher to gather information from a large number of respondents quickly and cost-effectively and assure respondents of anonymity and confidentiality.

3.8 Data Collection Procedures

Data collection is the practice of acquiring empirical information to address research questions and provide fresh perspectives on a circumstance (Taherdoost, 2021). In this study, the research questions called for adoption of various methods of data collection. Therefore, the researcher employed three methods of data collection, as follows: -

Observation Checklist: Site visits and observation of 10 ongoing public housing projects in Kenya was conducted using the observation checklist tool in Appendix III. These visits allowed the researchers to make empirical observations of adoption of various categories of sustainability aspect in design and implementation of public housing in Kenya. The choice of site visit methodology aligns well with a study by Smith and Brown, (2020) who evaluated sustainable housing developments through site visits. The 10 sites were selected on the basis of financial and time availability.

Survey Questionnaire: Online administration of the questionnaire entailed the use of SurveyMonkey technique. SurveyMonkey enabled the study to create customized surveys tailored towards addressing the study's objectives. The platform's distribution capabilities

allowed for efficient dissemination of surveys via email, social media, or embedded links, facilitating broad reach across diverse participant groups. SurveyMonkey adhered to Institutional Review Board (IRB) guidelines and ensured that data collection complied with ethical standards required in academic research (SurveyMonkey, 2024).

Focus Group Discussion: FGD was applied in gathering data from key stakeholders in the housing sector in Kenya. Focus group discussion is an unstructured method used to gather primary data on insights from a single respondent, focusing on understanding the characteristics and nature of the subject (Kothari, 2017). The study invited 1 representative from organizations in Table 3.1 (head of institution or the technical lead) for the FGD, resulting in a sample of 39 respondents. This approach was consistent with Moore et al. (2015) who applied FGD to gather data from 10 respondents in a study of housing in the UK. The FGDs were expected to take 2 hours to allow effective data collection from discussants across time periods (Malhotra, 2020). In this study, one FGD was done, and it took 3 hours.

3.9 Data Analysis and Presentation

Wickham (2016) defined data analysis as the methodical process of looking at, analyzing, and modeling data in order to find relevant information, make inferences, and aid in decision-making. In this study, the researcher carried out quantitative data analysis followed by qualitative analysis. While analysis of the checklist data gave 'gross 'and objective ratings of housing sustainability, analysis of the questionnaire and FGD data gave the respondents ' sentiments on the relationships amongst the variables and what needs to be done to improve the situation.

The quantitative analysis adopted simple statistics – frequencies and descriptive – using the Statistical Packages for Social Scientists (SPSS for Windows, Version 26). This was applied on the observation checklist data and on the survey questionnaire data. And the findings were presented in the form of tables, histograms, graphs, and written explanations. The FGD data was subjected to thematic analysis to bring out dominant themes, patterns, and meanings using NVivo for Window (Version 10). Lexical analysis was done to give a visualization of the themes.

3.10 Research Quality

The quality of this study was informed by rigorous methodological practices, ensuring validity

and reliability in the findings. Precise inclusion criteria defined the participant groups from the population, thereby limiting confounding variables and enhancing generalizability.

3.10.1 Validity

In a qualitative study the main threats to validity relate to researcher bias, reactivity and respondent bias (Robson, 2002). The study applied the strategies suggested by Robson that "prolonged involvement, triangulation, peer debriefing, member checking, negative case analysis and keeping an audit trail (Robson, 2002, p.: 174)" to mitigate against the threat of validity. The quantitative component of the study examined three aspects of validity: face validity, content validity and internal construct validity.

3.10.2 Reliability

In a qualitative study this measure relates to how thorough, careful and honest one is throughout the research process (Robson, 2002). Certain aspects of the focus group discussion process such as wording of discussion questions, building rapport with the discussants and considering power interplay between the researcher and the research respondents were carefully balanced to assure reliability (Cohen et al., 2007). The Cronbach's alpha scale test was deployed in examining the reliability of the instrument.

3.11 Ethical Considerations

Ethical issues were carefully considered before data collection began. Ethical clearance was sought from Strathmore University's Internal Review Board to ensure compliance with research ethics. Additionally, a permit to collect data from the public was obtained from the National Commission for Science, Technology and Innovation (NACOSTI). An ethical approval (Appendix I) was obtained from SU-ISERC that spelt the scope of the study and confirmed the legitimacy of the researcher and the fact that the information gathered was to be used exclusively for research purposes. Confidentiality and anonymity were maintained, and respondents' answers were handled with the highest level of discretion. Prior to the commencement of data collection, all respondents provided written informed consent (Appendix IX), ensuring voluntary participation. The question guides were coded to protect respondents' identities and maintain anonymity.

Throughout the research process including data collection, analysis, and reporting, the researcher upheld integrity by ensuring that no data is falsified, misrepresented, or manipulated as explained under the Data Management in section 2.10 of the Appendix IX. To maintain academic integrity, all sources of information were appropriately cited, and a comprehensive list of references was included to acknowledge the contributions of other authors. This helped mitigate the risk of plagiarism and ensure transparency in scholarly work. Additionally, copyright regulations were observed by properly citing figures, tables, and other materials sourced from published works, hence adhering to intellectual property guidelines.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter presents the data analysis outcomes and their interpretation. It starts with the quantitative analyses of the data collected followed by qualitative analyses of the same. While the quantitative data analysis addresses the levels of housing sustainability and the factors that influence that sustainability, the qualitative data analysis was applied on the focus group discussion data. As stated before, the researcher considered all three data collection methods to be of equal importance, and synergistic to the understanding of the research question. Therefore, the sequence of analysis and/or presentation of the findings does not imply a rating of importance of the observations. Each of the three data sets was considered on its own right to address the research question, and all the research objectives, albeit in a limited way. Hence the need for triangulation. Since the unit of analysis is one the public housing sector of Kenya – the data sets talk to each other and talk about the same object. It is in the chapter conclusion where findings from the three data sets are integrated to give the overall picture of the housing sustainability in Kenya.

4.2 Response Rates

Fieldwork was undertaken on three fronts: First, site visits to 10 ongoing affordable housing development projects in Kenya, where an observation checklist was employed. Second, online administration of survey questionnaires to a sample of 342 key housing stakeholders. Third, Focus Group Discussion of 27 key stakeholders in the housing sector. These numbers represent response rates of 100%, 89% and 69%, respectively. According to Babbie (2020), a response rate of 50% is considered adequate, 60% is‘ good, and 70% and above is‘ very good. Therefore, the response rates achieved were interpreted as all good, indicating that adequate data were collected to address the research question. Accordingly, the research findings should be credible and dependable.

4.3 Validity and Reliability of Research Instruments

The research instruments - Site Observation Checklist (Appendix III), Survey Questionnaire (Appendix IV), and Focus Group Discussion [FGD] Guide (Appendix V) - were evaluated for validity and reliability. Validity refers to the extent to which an instrument measures what it is intended to measure, ensuring the accuracy and meaningfulness of research findings (Creswell

& Creswell, 2018). The instruments were examined for face validity, content validity and internal construct validity by being given to two academic experts in the field and two practicing housing professionals. They were asked to test the instruments by determining how well they appeared and to assess if they were able to measure what they were supposed to measure using subjective judgment. They were also asked to review the questions' content to ensure that the instruments addressed and could test all key themes of the sustainability of housing in Kenya, which was the focus of the study. Feedback arising from the experts was incorporated into the tools, thereby improving the validity.

Subsequently, the instruments were pilot tested. The FGD guide, observation checklist, and questionnaires were given to ten housing experts at NHC in Nairobi. They were asked to identify any gaps in the questions and their clarity, suggest improvements, and provide feedback on the overall flow of questions in the three instruments. Based on their responses and feedback, the tools were improved for clarity and in some cases the order of questions was adjusted. Following the face validity check, content validity check and the pilot study, the three instruments were interpreted as meeting the validity criteria as explained in Creswell & Creswell (2018).

The Item-Total Statistics were used in reliability analysis to evaluate internal consistency of the research questionnaire through Cronbach's alpha, as shown on Table 4.1. The table shows that the overall Cronbach alpha for the 31-item questionnaire was 0.920, which was interpreted to mean an excellent internal consistency, suggesting that the items reliably measured the same underlying construct. Field (2013) defines an instrument as reliable if its overall alpha is ≥0.7. As a result, the study instrument was considered to be reliable.

Table 4.1: Item-Total Statistics

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Interpretation
Existing Housing Policies	10.4624	3.900	0.567	0.777	Acceptable item. Removing it slightly increases alpha, but it's still contributing positively.
Existing Legislations	10.0660	3.503	0.771	0.773	Strong item. It has the highest correlation, indicating strong consistency with the overall scale.
Existing Housing Approaches	10.0163	3.895	0.676	0.725	Very good item. Removing it would reduce the scale's reliability.
Adoption of Innovative Housing Designs	9.2373	4.190	0.472	0.821	Weakest item. Removing it would increase Cronbach's alpha, suggesting it may reduce the internal consistency.
Overall Cronbach's Alpha (31 Items)				0.920	

The four main constructs in the study - existing policies, existing legislations, existing housing approaches and adoption of innovative housing designs - were subjected to a scale test to determine their internal construct validity. Table 4.1 shows assessment of the reliability of the survey instrument by examining the contribution of each item to the overall scale's consistency. The column of Cronbach's alpha if item deleted indicates what Cronbach's alpha (α) would be if that item were removed from the scale. If this value is lower than the overall alpha, it means the item is contributing positively to the scale's reliability. The results show that existing policies had $\alpha = 0.777$, legislations had $\alpha = 0.773$, existing housing approaches had $\alpha = 0.725$ and adoption of innovative housing designs had $\alpha = 0.821$. The resulting Cronbach's alpha if item deleted for the four key constructs in the study were all less than the overall Cronbach's alpha = 0.920 of the instruments. This meant that all the constructs were contributing positively to the scale's reliability and therefore met the internal consistency threshold according to Field (2013).

4.4 Analysis of Site Visit Data

This section presents the results of housing site visits undertaken by the researcher to observe the level of adoption of sustainability in sampled housing projects in Kenya. A site visit analysis is a structured report that documents observations, findings, and recommendations from an on-site inspection, in this case some ongoing public housing projects. In the current study, site visit data collected on the basis of an observation checklist served as an important mechanism for the more

nuanced understanding of the current levels of sustainability of housing development in Kenya, at the micro/project level of the sector.

4.4.1 Housing Sites Performance: Positive Response Rate Per Question

Analysis of the ongoing housing projects in Figure 4.1 overleaf shows strong performance in several areas of sustainability in housing, with positive response rates reaching 90-100% for site layout optimization (views, wind direction and sunlight), environmental impact mitigation, and contributions to community and economic development. More specifically, projects consistently demonstrated effective site layout for views, wind, and sunlight (90%, 50%, and 30% respectively), implemented measures to minimize environmental impact (100%), and contribution to local economies (100%).

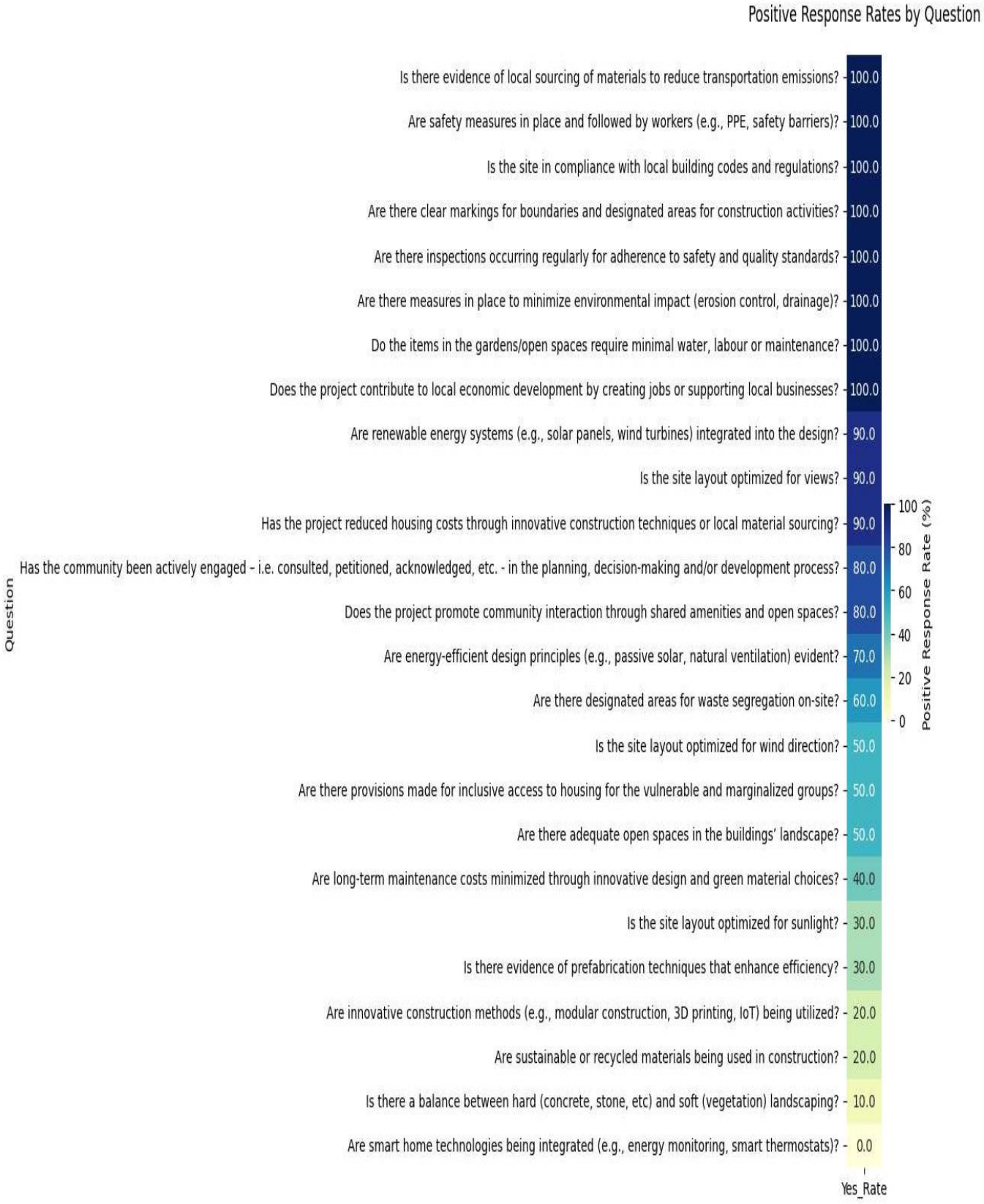

Figure 4.1: Housing Sites Performance: Positive Response Rate Per Question

However, significant weaknesses were also apparent. The observed projects generally showed poor results in the use of sustainable or recycled materials (20%), innovative construction methods (20%), inclusivity and accessibility for vulnerable groups (50%). Furthermore, the integration of energy-efficient design principles (70%) and smart home technologies (0%) was low, as it was achieving a balance between hard and soft landscaping (10%). The provision of adequate open spaces (50%) and the minimization of long-term maintenance costs (40%) also indicated areas needing improvement.

4.4.2 Housing Sites Performance: Comparison per Project

The analysis of housing sites' performance in Figure 4.2 shows variability in positive response rates across the 10 housing development projects observed. Embu AHP demonstrated the highest performance with an 84% positive response rate, indicating strong adherence to the sustainability criteria laid out in the observation checklist. In contrast, Ruiru and Soweto exhibited the lowest performance, both at 48%, suggesting significant shortcomings in meeting the checklist standards. Mavoko, Shauri, South B, and South C showed mid-to-high performance, all registering 76% while Kiri AHP had 72%. Additionally, Park Road and Woodley each achieved 56%.

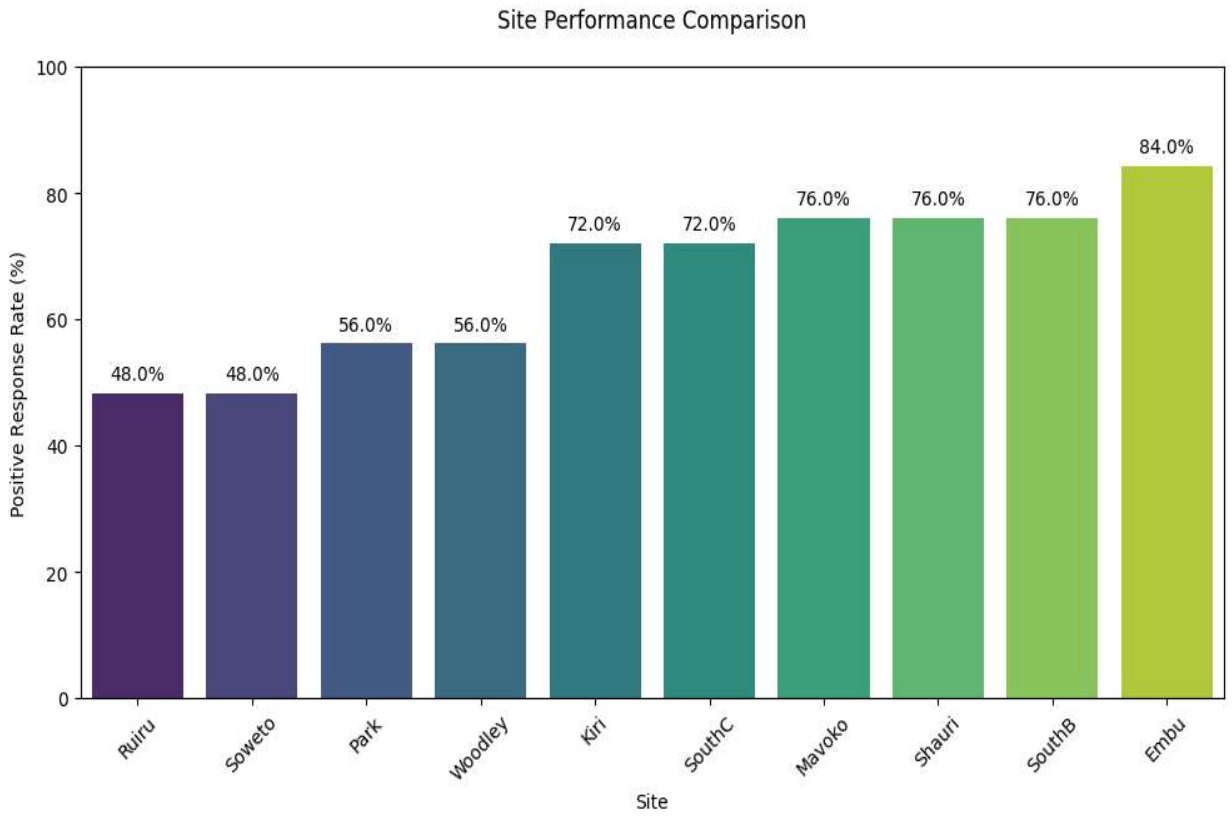

Figure 4.2: Housing Sites Performance: Comparison per Project

4.4.3 Housing Sites Sustainability Performance by Category

The analysis of sustainability performance by category displayed in Figure 4.3 captures a wide range of positive response rates, from 100% in Environmental and Safety/Compliance to a low of 40% in Economic aspects, indicating significant variation in how sustainability was being addressed across different areas of housing. While Environmental and Safety/Compliance demonstrated excellent performance at 100%, other categories showed a declining trend: Landscaping at 75%, Social Impact at 65%, Other at 62%, Site Planning at 57%, Energy Efficiency at 54%, and Construction at 50%. This distribution highlights strong sustainability performance in the regulated aspects of housing projects such as environmental and safety criteria but points to substantial weaknesses on the design and implementation sustainability aspects which are more developer dependent than compliance requirements, particularly in the economic considerations, construction technology, innovation and energy efficiency.

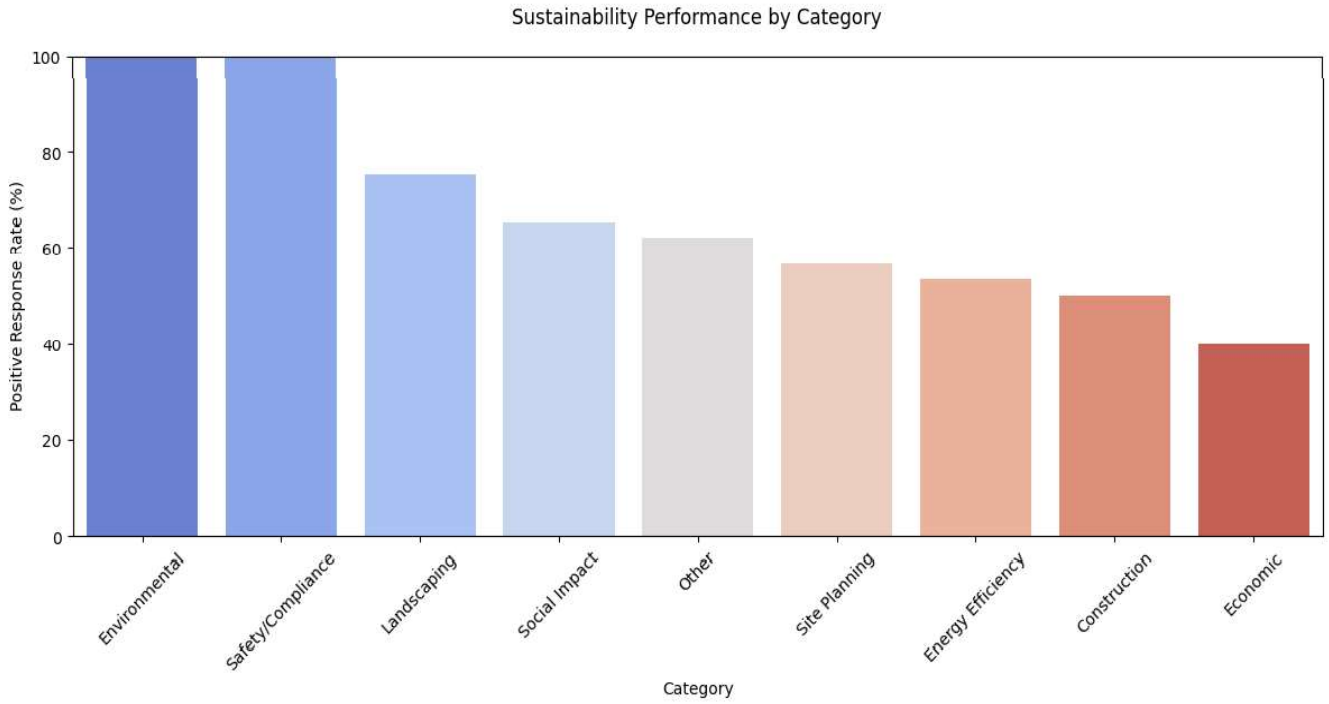

Figure 4.3: Sustainability Performance by Category

4.4.4 Statistical Significance Test on the Observed Sustainability Performance of Housing Sites

The statistical analysis revealed a significant difference in sustainability performance between the selected sites. Difference in performance was also observed between categories of sustainability selected. The comparison between Embu (highest performing site) and Soweto (lowest performing site) yielded a chi-square p-value of 0.0169, indicating a statistically significant difference in their overall sustainability. This confirms that Embu's better sustainability performance was not due to chance. Similarly, the comparison between the Environmental category (highest performing) and the Economic category (lowest performing) resulted in a chi-square p-value of 0.0007, demonstrating a stronger significant difference between the two sustainability categories. These low p-values provide strong evidence that the observed disparities in performance between the environmental and economic categories of sustainability are real and not merely random variations, highlighting the necessity for targeted interventions and more encompassing to address specific areas and sites of underperformance.

4.4.5 Radar Chart for Comparison of Housing Sites Sustainability Performance

The radar chart illustrated in Figure 4.4 shows the comparative sustainability performance of various housing development sites, revealing a spectrum of positive response rates. Embu exhibited the highest performance, closely followed by Mavoko, indicating strong adherence to the assessed sustainability criteria. Kiri and Park sites demonstrated moderate performance, while Ruiru and Shauri showed comparatively lower positive response rates, suggesting potential areas for improvement.

Soweto, South B, South C, and Woodley displayed the lowest performance among the sites, highlighting significant challenges in meeting the sustainability standards as measured by the checklist. The chart effectively visualized the variability in sustainability implementation across the sites, with Embu and Mavoko standing out as leaders and Soweto, South B, South C, and Woodley indicating a need for more focused attention to enhance sustainability practices.

Figure 4.4: Radar Chart for Comparison of Housing Sites Sustainability Performance

4.4.6 Key Findings on Sustainability Performance of Ongoing Housing Sites

The analysis of housing sustainability in the output below shows that the top three best-implemented sustainability practices were local sourcing of materials to reduce transportation emissions, the presence and adherence to safety measures for workers, and compliance with provisions of the building code and regulations, all achieving 100% positive response. In contrast, the most wanting practices were the use of sustainable or recycled materials in construction (20% positive), balancing hard and soft landscaping (10% positive), and the integration of smart home technologies (0% positive).

Site performance rankings indicated that Embu led with 84.0% positive responses, followed by Mavoko, Shauri, and South B at 76.0%, while Soweto and Ruiru lagged at 48.0%. Category performance showed Environmental and Safety/Compliance at 100%, with a decline through Landscaping (75.0%), Social Impact (65.0%), Others (62.0%), Site Planning (56.7%), Energy Efficiency (53.3%), and Construction (50.0%), to the lowest in Economic performance at 40.0%. Overall, on the assessment scale used in this study, the average positive score was 16.60 out of 25, which reflects 66.40% sustainability achievement of the observed ongoing projects. This portrays a better picture than the picture portrayed by the questionnaire and FGD data, as shown later. Additionally, it is not certain whether a similar picture would obtain if conventional sustainability rating tools were applied. For practical reasons, use of the conventional sustainability rating tools - LEED, EDGE, or the like - was outside the scope of this study. This is therefore suggested as an area for further study.

4.5 Analysis of Survey Questionnaire Data

The data generated through the survey was subjected to descriptive analysis giving the respondent profile and frequencies of existing housing policies, legislations, approaches and design innovations. Frequencies and percentages are given for each of the variable surrogates, expressed in the questions posed to the respondent. And from the surrogate scores, frequencies/percentages for each of the sustainability determinant factors were deduced. On the 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree' a dichotomy of 0 and 1 is implied, whereby 0 = strongly disagree or disagree, and 1 = moderately agree or agree or strongly agree. These were the opinions of the respondents regarding the extent to which existing housing policies, legislations, approaches and designs have so far contributed to housing sustainability in the country. Therefore, the frequency/percentage score is a reflection of the expected probability of each determinant surrogate/factor to cause housing sustainability, as things stand in Kenya today.

4.5.1 Respondent Profile

Table 4.2 presents aspects of professional profiles of the 342 participants involved in housing-related matters in Kenya. The study sought to assess the experience of the respondents and found out that nearly half (47.7%) of the respondents had been engaged in the sector for more

than 16 years, while 21.9% had 6–10 years of experience and 16.1% had 11–15 years, indicating a highly experienced cohort. This depth of experience suggests that the participants possessed substantial knowledge of the housing sector in Kenya.

Table 4.2: Profile of the Participants

Variable	Response	Frequency	Percent	Cumulative Percent
How long have you been involved in housing-related matters in Kenya?	Less than 5 years	49	14.3	14.3
	6-10 years	75	21.9	36.3
	11-15 years	55	16.1	52.3
	More than 16 years	163	47.7	100.0
In which area of housing are you involved?	Policymaker	49	14.3	14.3
	Developer	41	12.0	26.3
	Professional	197	57.6	83.9
	Financial institution	10	2.9	86.8
	Contractor	21	6.1	93.0
	Other	24	7.0	100.0
How would you rate your knowledge of sustainability of housing practices	Very low	7	2.0	2.0
	Low	9	2.6	4.7
	Moderate	125	36.5	41.2
	High	127	37.1	78.4
	Very High	74	21.6	100.0
	Total	342	100.0	

In terms of roles of the participants in housing, Figure 4.5 shows that a majority of participants identified as professionals (57.6%), encompassing roles such as architects, quantity surveyors, engineers, urban planners, project managers among others. Policymakers who comprised 14.3% and developers (12.0%) also constituted notable segments. The presence of financial institution representatives (2.9%) and contractors (6.1%) indicates a diverse stakeholder representation, essential for comprehensive perspectives on sustainability of housing phenomenon under investigation.

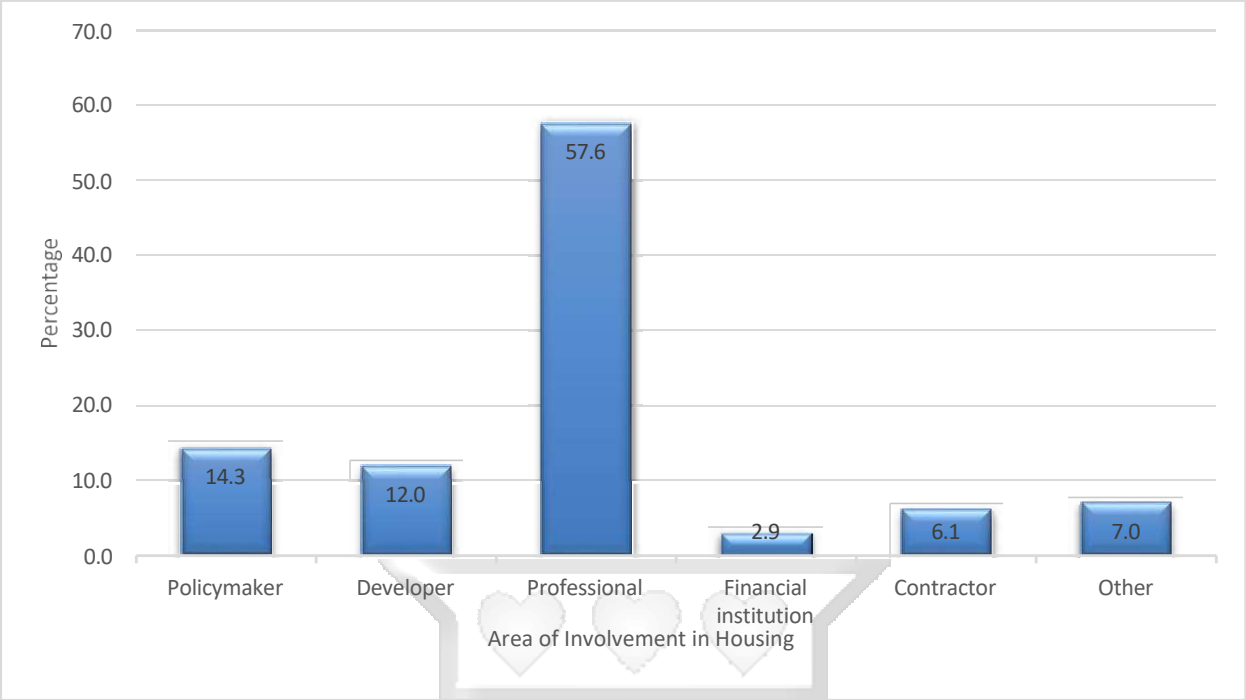

Figure 4.5: Areas of Involvement in Housing

When assessing self-reported knowledge of sustainability of housing practices, Table 4.2 above shows that most of the participants (37.1%) rated their knowledge as high, 36.5% as moderate, 21.6% as very high, and a small proportion rated it as low (2.6%) or very low (2.0%). These findings indicate that the participant pool comprises experienced individuals with substantial professional involvement and a generally high level of awareness regarding sustainability of housing practices. These findings indicate that the participants in the study had extensive experience and professional diversity that enabled them to make significant contribution to the study on the topic of sustainability of housing practices in Kenya.

4.5.2 Analysis of Existing Housing Policies

The study sought to find out the extent to which the existing housing policies have so far contributed to sustainability of housing in Kenya. The data on existing housing policies was subjected to descriptive statistical analysis in terms of measures of frequencies (count, percentage and frequency distribution), as well as measures of central tendency and dispersion (mean, mode and standard deviation) and measures of dispersion (range, variance and standard deviation).

Table 4.3 shows that most of the respondents moderately agreed (38%) and 24% agreed that national housing policies had a positive influence on sustainability of housing development. This meant that the respondents generally had a positive perception of the role of national housing policies in promoting sustainability of housing, though a notable proportion of respondents expressed reservations, indicating that there was need for refinement of the housing policies to address stakeholder concerns and maximize impact.

On the question of the Affordable Housing Programme (AHP) has significantly improved sustainability of housing development, a larger majority of the respondents (33.3%) moderately agreed, which may indicate cautious optimism or acknowledgment need for partial improvements. Table 4.3 shows that a combined 45.1% of respondents either disagreed (28.7%) or strongly disagreed (16.4%) with the statement. This level of dissent implied existence concerns or doubt about the effectiveness or execution of the AHP in delivering on its sustainability goals existed amongst the housing stakeholders.

When asked if the if The National Urban Development Policy (NUDP) had effectively led to sustainable urbanization, it was observed that 65% of respondents (40.1% moderately agree, 19.9% agree, and 5.0% strongly agree) expressed some level of agreement, suggesting that a majority view the NUDP as contributing to sustainable urbanization, though often not strongly. The existence of 25.7% respondents who disagreed and 9.4% who strongly disagreed on Table 4.3, implied that over a third of stakeholders do not believe the policy has been effective, which may point to implementation gaps, policy limitations, or communication issues.

Table 4.3 also presents the response on perceptions of the effectiveness of government policies in promoting Public-Private Partnerships (PPPs). The results show that most of the respondents (41.2%) moderately agreed, 24.9% agreed, 19.6% disagreed that government policies in promoting PPPs were effective. The fact that the largest single group selected moderately agreed indicated that while respondents recognize efforts made by the government, many are cautiously optimistic rather than fully convinced. From Table 4.3, most of the participants moderately agreed (34.8%), 27.2% disagreed and 12.6% strongly disagreed that building maintenance policies have significantly enhanced the development of sustainability of housing. Cumulatively, most of the respondents (39.8%) disagreed, the significant portion of disagreement highlights a need for stronger implementation and enforcement of building

maintenance policies.

Table 4.3: Existing Housing Policies

Variable	Response	Frequency	Percent	Cumulative Percent
National housing policies have significantly enhanced the development of sustainability of housing.	Strongly Disagree	22	6.4	6.4
	Disagree	71	20.8	27.2
	Moderately agree	130	38.0	65.2
	Agree	82	24.0	89.2
	Strongly Agree	37	10.8	100.0
The Affordable Housing Programme (AHP) has significantly improved sustainability of housing development.	Strongly Disagree	56	16.4	16.4
	Disagree	98	28.7	45
	Moderately agree	114	33.3	78.4
	Agree	46	13.5	91.8
	Strongly Agree	28	8.2	100
The National Urban Development Policy (NUDP) has effectively led to sustainable urbanization.	Strongly Disagree	32	9.4	9.4
	Disagree	88	25.7	35.1
	Moderately agree	137	40.1	75.1
	Agree	68	19.9	95.0
	Strongly Agree	17	5.0	100.0
Government policies have effectively promoted Public-Private Partnerships.	Strongly Disagree	24	7.0	7.0
	Disagree	67	19.6	26.6
	Moderately agree	141	41.2	67.8
	Agree	85	24.9	92.7
	Strongly Agree	25	7.3	100.0
Building maintenance policies have significantly enhanced the development of sustainability of housing.	Strongly Disagree	43	12.6	12.6
	Disagree	93	27.2	39.8
	Moderately agree	119	34.8	74.6
	Agree	71	20.8	95.3
	Strongly Agree	16	4.7	100
Public participation is adequately incorporated in the development of housing policies and programs.	Strongly Disagree	81	23.7	23.7
	Disagree	101	29.5	53.2
	Moderately agree	92	26.9	80.1
	Agree	47	13.7	93.9
	Strongly Agree	21	6.1	100
Government policies are adequate for sustainability of housing development.	Strongly Disagree	57	16.7	16.7
	Disagree	107	31.3	48
	Moderately agree	109	31.9	79.8
	Agree	53	15.5	95.3
	Strongly Agree	16	4.7	100
	Total	342	100	

Figure 4.6 shows that cumulatively 53.2% of respondents (23.7% strongly disagree + 29.5% disagree) believe that public participation is not adequately incorporated in the development of housing policies and programs. This majority disapproval suggests a perceived disconnect between policy-making processes and community involvement. It is noted from Figure 4.6 that 26.9% moderately agree, and only 13.7% agree with the statement. This indicates that while some respondents recognize partial or limited involvement of the public**,** few believe it is truly adequate**.** The responses are fairly spread out but skewed toward disagreement. This means that public participation in housing policy and program development is perceived as inadequate by a majority of respondents. It implies that there is a clear call for more inclusive, participatory policy-making frameworks.

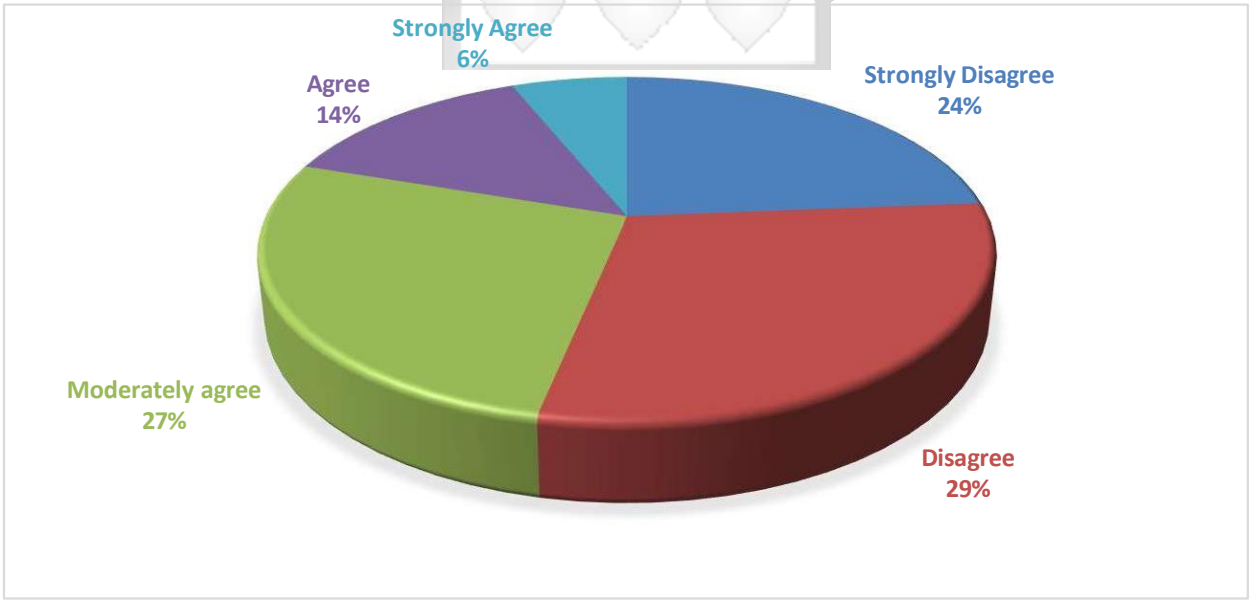

Figure 4.6: Public participation and the development of housing policies and programs

From Table 4.3, most of the respondents moderately agree (31.9%**)** that government policies are adequate, 31.3% disagree and 16.7 strongly disagree. The responses show that while there is some recognition that government policies may contribute partially to sustainability of housing development, many respondents do not believe they are adequate overall.

Combining the positive scores for all the indicators on Table 4.3 whereby 0 = strongly disagree or disagree, and 1 = moderately agree or agree or strongly agree which gives an overall average percentage of 60.83% for the housing policies in Kenya. This reflects the respondents'

estimation of the probability that the housing policies of Kenya will deliver the elusive sustainability dream to the people. In their opinion, the policies have done something and may do something in the future, but they are not yet adequate. The dissenting response portion, 39.17%, is considerable and implies that something is seriously missing in the policy designs and/or implementations.

4.5.3 Analysis of Existing Housing Legislations

The study analyzed the extent to which the existing housing legislations in terms of laws, regulations and codes have so far contributed to sustainability of housing in Kenya. Using a 5-point Likert scale and frequency analysis, the study sought to examine respondents' perceptions of whether existing land use legislations such as the Land Act and the Urban Areas and Cities Act - influenced the sustainability of housing in Kenya.

The findings on Table 4.4 show that a plurality of respondents (39.2%) moderately agreed that these legislative frameworks contribute to sustainability. This suggests a generally cautious but positive acknowledgment of the role such laws may play. In addition, 21.9% agreed and 6.4% strongly agreed, bringing the total proportion of those expressing some level of agreement to 67.5%. This indicates that over two-thirds of respondents perceive these legislations as contributing positively to sustainability of housing efforts. Of a contrary opinion were 27.2% respondents who disagreed and 5.3% who strongly disagreed, representing 32.5% of the sample who were skeptical or outrightly dismissed the contribution of land use policies to sustainability. Overall, the results indicate a generally favorable perception among respondents, although a significant minority remains unconvinced.

The study assessed respondents' perceptions of the contribution of housing development legislation including the Housing Act Cap. 117, the National Construction Authority (NCA) Act of 2011, and the Affordable Housing Act of 2024, to the sustainability of housing. The findings on Table 4.4 indicate that a significant proportion of respondents moderately agreed (38.3%), 25.1% agreed, and 7.0% strongly agreed that these laws are contributing to sustainability of housing development.

Combined, this accounts for 70.4% of the respondents, indicating a generally positive sentiment toward the effectiveness of the cited legislation.

On the other hand, 22.8% disagreed and 6.7% strongly disagreed, totaling 29.5%, who expressed skepticism or dissatisfaction with the contribution of the legal framework. The outcome in Table 4.4 implies that while a majority view current housing-related legislation as playing a positive role in promoting sustainability of housing, a notable minority remain unconvinced. This could reflect differing experiences with the implementation or perceived impact of these laws across different regions or stakeholder groups.

The study sought to assess the perceived role of the Public-Private Partnership (PPP) Act in promoting sustainability of housing initiatives. From Table 4.4, it was observed that specifically, 31.6% of respondents moderately agreed, 31.3% agreed, and 6.7% strongly agreed that the PPP Act contributes positively to sustainability of housing. Cumulatively these categories represent 69.6% of the participants, indicating a strong belief in the supportive role of the PPP framework in advancing sustainability of housing objectives. Conversely, 22.8% disagreed, and 7.6% strongly disagreed, accounting for a total of 30.4% who were skeptical about the Act's contribution. The outcome meant that while most of the participants acknowledge the positive influence of the PPP Act, a significant portion remains unconvinced. This may point to gaps in policy implementation, lack of awareness, or regional disparities in the effectiveness of PPP-driven housing projects. The findings highlight the importance of strengthening PPP frameworks and ensuring equitable distribution.

The study examined respondents' views on whether there are adequate institutions to drive sustainability of housing efforts. The findings on Table 4.4 indicate that a combined 73.1% of participants either moderately agreed (23.7%), agreed (33.0%), or strongly agreed (16.4%) that sufficient institutional frameworks are in place to promote sustainability of housing. This suggests that a majority of the respondents recognize the presence of organizational structures capable of steering sustainability of housing initiatives.

However, 26.9% of the respondents expressed a contrary view, with 7.3% strongly disagreeing and 19.6% disagreeing with the adequacy of current institutions as shown on Table 4.4. This reflects a moderate level of skepticism, possibly due to perceived inefficiencies, coordination challenges, or limited visibility of institutional impact on sustainability of housing at the grassroots level. These findings imply that while institutional frameworks may exist, their perceived effectiveness and accessibility could be areas of concern. For policy and planning

purposes, this reveals the need for strengthening institutional capacities, improving coordination, and enhancing public awareness of institutional roles in sustainability of housing development.

Table 4.4: Existing Housing Legislation

Variable	Response	Frequency	Percent	Cumulative Percent
Legislations governing land use (e.g. Land Act, Urban Areas and Cities Act) are contributing for sustainability of housing.	Strongly Disagree	18	5.3	5.3
	Disagree	93	27.2	32.5
	Moderately agree	134	39.2	71.6
	Agree	75	21.9	93.6
	Strongly Agree	22	6.4	100.0
Legislations related to housing development (e.g. Housing Act Cap. 117, NCA Act of 2011 and Affordable Housing Act of 2024) are contributing to sustainability of housing.	Strongly Disagree	23	6.7	6.7
	Disagree	78	22.8	29.5
	Moderately agree	131	38.3	67.8
	Agree	86	25.1	93
	Strongly Agree	24	7	100
The Public-Private Partnership Act contributes positively to sustainability of housing initiatives.	Strongly Disagree	26	7.6	7.6
	Disagree	78	22.8	30.4
	Moderately agree	108	31.6	62.0
	Agree	107	31.3	93.3
	Strongly Agree	23	6.7	100.0
There are adequate institutions to drive sustainability of housing.	Strongly Disagree	25	7.3	7.3
	Disagree	67	19.6	26.9
	Moderately agree	81	23.7	50.6
	Agree	113	33	83.6
	Strongly Agree	56	16.4	100
Building codes enforce sustainability standards in housing.	Strongly Disagree	19	5.6	5.6
	Disagree	55	16.1	21.6
	Moderately agree	94	27.5	49.1
	Agree	102	29.8	78.9
	Strongly Agree	72	21.1	100
There are adequate capacities (e.g. managerial, material, technical and skills) to drive sustainability of housing.	Strongly Disagree	23	6.7	6.7
	Disagree	61	17.8	24.6
	Moderately agree	88	25.7	50.3
	Agree	104	30.4	80.7
	Strongly Agree	66	19.3	100
Existing framework of laws, regulations and institutions is adequate for sustainability of housing development.	Strongly Disagree	29	8.5	8.5
	Disagree	77	22.5	31
	Moderately agree	100	29.2	60.2
	Agree	84	24.6	84.8
	Strongly Agree	52	15.2	100

	Total	342	100

The study sought to determine the extent to which respondents perceive that building codes effectively enforce sustainability standards in housing. The results in Table 4.4 reveal a predominantly positive perception, indicating confidence in the regulatory role of building codes. A total of 78.4% of respondents either moderately agreed (27.5%), agreed (29.8%), or strongly agreed (21.1%) that building codes contribute to the enforcement of sustainability standards in housing. This majority suggests that the regulatory framework based on building codes was generally viewed as an important tool for ensuring environmentally responsible and resource-efficient construction practices.

On the other hand, Figure 4.7 shows a minority of 21.6% expressed disagreement, with 16.1% disagreeing with and 5.6% strongly disagreeing. This meant that a portion of the respondents may perceive gaps in enforcement, coverage, or awareness of sustainable provisions within existing building codes. These findings suggest that building codes are widely seen as instrumental in guiding sustainability of housing practices. However, they also underscore the need for continuous review and enforcement of these codes to address emerging sustainability challenges, enhance compliance, and bridge any existing implementation gaps. Strengthening institutional capacity for enforcement and providing technical support to stakeholders may further improve the effectiveness of building codes in advancing sustainability of housing goals.

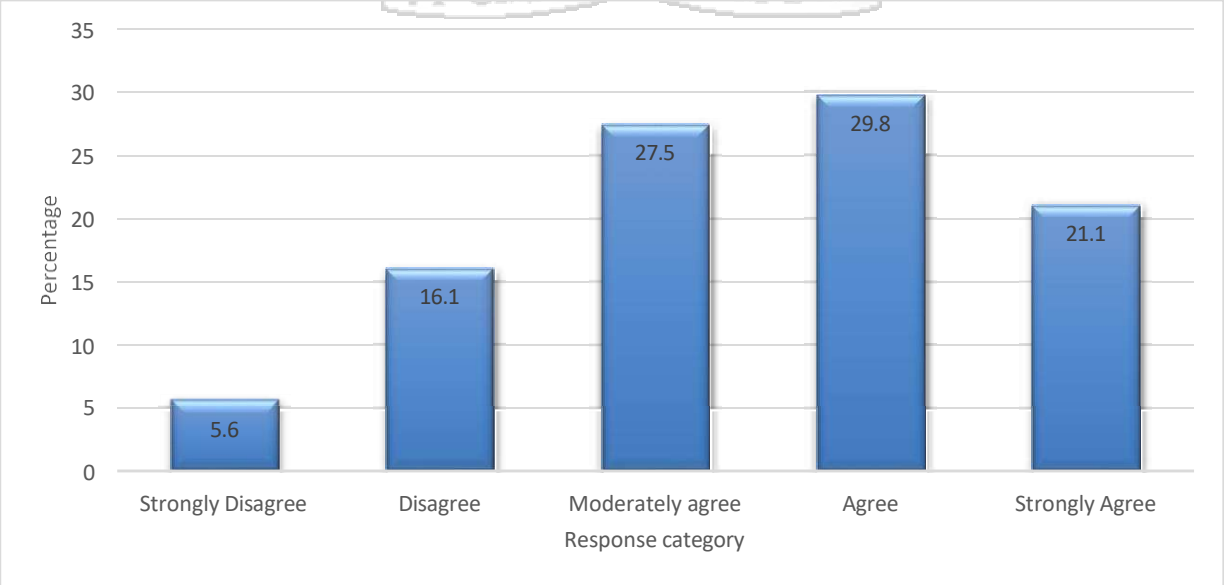

Figure 4.7: Effectiveness of Building Codes in Enforcing Sustainability Standards

Using frequency analysis, an examination of the respondents' perceptions regarding the adequacy of capacities, encompassing managerial, material, technical, and human skills to effectively drive sustainability of housing initiatives was pursued. Results from Table 4.4 indicate that a significant majority of respondents expressed confidence in the availability of such capacities. Specifically, 30.4% agreed and 19.3% strongly agreed, while 25.7% moderately agreed, totaling 75.4% of the respondents who believe that adequate capacities exist. This suggests a generally positive outlook toward institutional and sectoral preparedness in terms of resources and competencies required for implementing sustainability of housing strategies. Conversely, 24.6% of respondents expressed doubt about the adequacy of such capacities, with 17.8% disagreeing and 6.7% strongly disagreeing. This indicates a minor but notable proportion of stakeholders who may perceive limitations, possibly due to uneven distribution of skills, insufficient materials, or gaps in technical expertise across regions or institutions.

The results underscore the importance of not only maintaining but also enhancing existing capacities to support sustainability of housing delivery. Continuous training, access to modern technologies, strengthening of institutional frameworks, and provision of adequate resources are key to ensuring that perceived capacity strengths translate into real-world impact. Addressing the concerns of the minority who perceive gaps is essential to achieving inclusive and comprehensive sustainability outcomes in the housing sector

Results on Table 4.4 indicate a generally positive perception regarding the adequacy of the existing framework of laws, regulations, and institutions for sustainability of housing development. A combined 68.9% of respondents either moderately agreed (29.2%), agreed (24.6%), or strongly agreed (15.2%) that the existing framework is adequate. This reflects a strong level of confidence in the legislative and institutional architecture supporting sustainability of housing initiatives. On the contrary, 31% of the respondents expressed disagreement, with 8.5% strongly disagreeing and 22.5% disagreeing. This suggests a significant minority perceives gaps or inadequacies in the current legal and institutional structures. These findings accentuate that while a majority recognize the sufficiency of current systems, there remains a notable proportion of stakeholders who may be experiencing challenges or have concerns about implementation, enforcement, or alignment of existing frameworks with sustainability objectives. Therefore, any policy reform should not only build on existing strengths but also address the specific shortcomings perceived by a substantial segment of the population.

Combining the positive scores for all the indicators on Table 4.4, whereby 0 = strongly disagree or disagree, and 1 = moderately agree or agree or strongly agree and gives an overall average percentage of 71.91% for the housing legislations in Kenya. This reflects the respondents' estimation of the probability that the housing legislations of Kenya will deliver the sustainability dream to the people. In their opinion, the legislation has had a significant positive impact, but they are not yet adequate. The dissenting respondents, 28.09%, are a significant proportion, which implies that something is seriously missing in the legislations' designs and/or implementations.

4.5.4 Analysis of Existing Housing Approaches

The study sought to find out the extent to which existing housing approaches have contributed to sustainability of housing in Kenya. The existing housing approaches were analyzed using frequency analysis and the findings displayed in Table 4.5 overleaf. First, the study examined the role of public housing developments implemented by county governments and those by the national government agencies (NHC and NSSF) including the outright sale, rental and tenants purchases schemes toward the achievement of sustainability of housing. The results show that cumulatively 76.9% of respondents expressed moderate to strong agreement (36.8% moderately agreed, 28.4% agreed, and 11.7% strongly agreed) that public housing initiatives have positively contributed to sustainability objectives in the housing sector. This suggests a broadly positive, though measured, endorsement of public sector interventions. Contrariwise, a combined 23.1% of respondents expressed disagreement (17.3% disagree, 5.8% strongly disagree), highlighting that while the majority perceive positive contributions, a noteworthy minority remains unconvinced. This disagreement may reflect dissatisfaction with the scale, quality, affordability, or accessibility of public housing projects. The findings imply that public housing schemes are generally perceived as contributing to sustainability of housing development, but with room for enhancement. To strengthen public confidence and maximize sustainability outcomes, there may be a need to scale up efforts, improve transparency and targeting, and ensure projects are aligned with comprehensive environmental and social sustainability standards.

Table 4.5: Existing Housing Approaches

Variable	Response	Frequency	Percent	Cumulative Percent
Public housing developments by national government agencies (e.g. the outright sale, rental and tenants purchase schemes by NHC and NSSF) and county governments have contributed to sustainability of housing.	Strongly Disagree	20	5.8	5.8
	Disagree	59	17.3	23.1
	Moderately agree	126	36.8	59.9
	Agree	97	28.4	88.3
	Strongly Agree	40	11.7	100.0
The Kenya Slum Upgrading Programme (KENSUP) has improved urban living standards and contributed to sustainability of housing.	Strongly Disagree	25	7.3	7.3
	Disagree	80	23.4	30.7
	Moderately agree	156	45.6	76.3
	Agree	59	17.3	93.6
	Strongly Agree	22	6.4	100.0
Employer-assisted housing schemes, such as the Civil Servants Housing Scheme Fund, have enhanced sustainability of housing.	Strongly Disagree	18	5.3	5.3
	Disagree	58	17.0	22.2
	Moderately agree	123	36.0	58.2
	Agree	103	30.1	88.3
	Strongly Agree	40	11.7	100.0
Private sector housing development and community-led initiatives (e.g. cooperatives and self-built housing) are contributing to sustainability of housing.	Strongly Disagree	16	4.7	4.7
	Disagree	23	6.7	11.4
	Moderately agree	97	28.4	39.8
	Agree	139	40.6	80.4
	Strongly Agree	67	19.6	100.0
The self-built and incremental housing are viable and affordable solutions to housing sustainability.	Strongly Disagree	15	4.4	4.4
	Disagree	43	12.6	17
	Moderately agree	88	25.7	42.7
	Agree	125	36.5	79.2
	Strongly Agree	71	20.8	100
Generally, existing housing approaches are adequate for promoting sustainability of housing.	Strongly Disagree	44	12.9	12.9
	Disagree	72	21.1	33.9
	Moderately agree	136	39.8	73.7
	Agree	64	18.7	92.4
	Strongly Agree	26	7.6	100
	Total	342	100	

The findings on Table 4.5 shows a predominantly positive perception of the Kenya Slum Upgrading Programme (KENSUP) in enhancing urban living standards and contributing to sustainability of housing. A total of 69.3% of respondents expressed moderate to strong agreement with the statement (45.6% moderately agreed, 17.3% agreed, and 6.4% strongly agreed). However, a notable 30.7% of respondents held negative views, with 23.4% disagreeing

and 7.3% strongly disagree. This suggests that while KENSUP is broadly recognized for its contributions, there is a significant minority that question its effectiveness or reach. Overall, the data underscores that KENSUP is perceived to have made important strides toward sustainability of housing, though its implementation may not have been uniformly effective across all contexts, signaling areas for further improvement and policy reinforcement.

The results on Table 4.5 indicate that employer assisted housing schemes, such as the Civil Servants Housing Scheme Fund, are largely perceived as enhancing the sustainability of housing. A combined 77.8% of respondents agreed to some extent with 36.0% moderately agreed, 30.1% agreed, and 11.7% strongly agreed highlighting a favorable public perception. Conversely, 22.2% expressed skepticism, with 17.0% disagreeing and 5.3% strongly disagreeing. Overall, the findings suggest that such schemes play a significant role in promoting sustainability of housing, although a smaller proportion of respondents remain unconvinced, indicating the need for enhanced implementation, communication, or accessibility of these programs.

Resulting from Table 4.5, it was noted that a strong support for the role of private sector housing development and community-led initiatives such as cooperatives and self-built housing existed in promoting sustainability of housing. A significant 88.6% of respondents expressed varying levels of agreement, with 28.4% moderately agreeing, 40.6% agreeing, and 19.6% strongly agreeing. In contrast, only 11.4% of respondents disagreed or strongly disagreed, suggesting limited skepticism. These results underscore the perceived importance of collaborative and market-driven approaches in enhancing housing sustainability and point to the growing credibility of decentralized and participatory housing models.

The findings on Table 4.5 further indicate strong support for the view that self-built and incremental housing are viable and affordable solutions to sustainability of housing. A combined 57.3% of respondents either agreed (36.5%) or strongly agreed (20.8%), while an additional 25.7% moderately agreed. Only a small proportion expressed disagreement, with 4.4% strongly disagreeing and 12.6% disagreeing. These results suggest a broad consensus recognizing the potential of self-built and incremental housing in addressing sustainability and affordability challenges in the housing sector.

The results in Table 4.5 reveal a mixed perception regarding the adequacy of existing housing approaches in promoting sustainability of housing. While most respondents (66.1%) expressed

moderate to strong agreement, 39.8% moderately agreed 18.7% agreed, and 7.6% strongly agreed, a significant proportion (33.9%) expressed dissatisfaction, with 12.9% strongly disagreeing and 21.1% disagreeing. This outcome was interpreted to mean that although many stakeholders acknowledge the relevance of current housing strategies, there is considerable concern about their overall effectiveness and implementation. The findings highlight the need for continuous evaluation and improvement of housing approaches to ensure they align with sustainability goals.

Combining the positive scores for all the indicators on Table 4.5, whereby, 0 = strongly disagree or disagree, and 1 = moderately agree or agree or strongly agree – gives an overall average percentage of 76.95% for the housing approaches in Kenya. This is higher than the averages for the policies or the legislation. It reflects the respondents' estimation of the probability that the housing policies of Kenya will deliver the sustainability dream to the people. In their opinion, the approaches have had positive impacts towards achievement of the sustainability dream. However, there is room for improvement; there is a portion of dissenting respondents, amounting to 23.05%. This calls for further refinement of the housing approaches.

4.5.5 Analysis of the Adoption of Innovative Housing Designs

The study sought to establish the extent to which the housing design innovations have contributed to sustainability of housing in Kenya and employed the use of frequency analysis and results displayed on Table 4.6. The first innovative housing design to be considered was passive design strategies, which were conceptualized as comprising adoption of approaches such as natural ventilation and solar energy utilization to enhance housing sustainability. A combined 76.6% of respondents agreed or strongly agreed with this statement, with 40.1% strongly agreeing and 36.5% agreeing. Only a small fraction of respondents expressed disagreement, with just 4.1% in total indicating either "disagree" or "strongly disagree." This high level of agreement demonstrated a strong consensus among stakeholders on the effectiveness of passive design approaches in promoting sustainability of housing.

From Table 4.6, adoption of passive design strategies in terms of natural ventilation and solar energy utilization in enhancing housing sustainability received a strong consensus with a significant 76.6% of respondents either agreeing (36.5%) or strongly agreeing (40.1%) with this statement. Only 4.1% expressed any form of disagreement, indicating minimal opposition.

This widespread agreement highlights that passive design was perceived as a critical and effective approach in promoting sustainability of housing.

Table 4.6: Innovative Housing Designs

Variable	Response	Frequency	Percent	Cumulative Percent
Passive design strategies (e.g. natural ventilation and solar energy utilization) enhances sustainability of housing.	Strongly Disagree	4	1.2	1.2
	Disagree	10	2.9	4.1
	Moderately agree	66	19.3	23.4
	Agree	125	36.5	59.9
	Strongly Agree	137	40.1	100.0
Passive design strategies (e.g. natural ventilation and solar energy utilization) enhances sustainability of housing.	Strongly Disagree	4	1.2	1.2
	Disagree	10	2.9	4.1
	Moderately agree	66	19.3	23.4
	Agree	125	36.5	59.9
	Strongly Agree	137	40.1	100.0
Water conservation systems (e.g. rainwater harvesting, waste water recycling) improve housing sustainability.	Strongly Disagree	9	2.6	2.6
	Disagree	11	3.2	5.8
	Moderately agree	68	19.9	25.7
	Agree	113	33.0	58.8
	Strongly Agree	141	41.2	100.0
Green infrastructure (e.g. green roofs, urban parks) enhances community social well-being and sustainability of housing.	Strongly Disagree	5	1.5	1.5
	Disagree	12	3.5	5.0
	Moderately agree	70	20.5	25.4
	Agree	113	33.0	58.5
	Strongly Agree	142	41.5	100.0
Smart home technologies (e.g. Internet of Things -IoT i.e. enabled monitoring and BIM) improves energy efficiency, security, convenience, maintenance and overall sustainability of housing.	Strongly Disagree	5	1.5	1.5
	Disagree	14	4.1	5.6
	Moderately agree	69	20.2	25.7
	Agree	121	35.4	61.1
	Strongly Agree	133	38.9	100.0
Adoption of modern construction techniques (e.g. modular housing, Light Gauge Framing Systems (LGFS) and prefabrication) enhances sustainability of housing.	Strongly Disagree	4	1.2	1.2
	Disagree	21	6.1	7.3
	Moderately agree	78	22.8	30.1
	Agree	124	36.3	66.4
	Strongly Agree	115	33.6	100.0
Generally, housing designs (e.g. sizes, configurations, typologies and materials) are determinants of sustainability of housing.	Strongly Disagree	8	2.3	2.3
	Disagree	13	3.8	6.1
	Moderately agree	63	18.4	24.6
	Agree	133	38.9	63.5
	Strongly Agree	125	36.5	100.0
	Total	342	100.0	

An analysis of adoption of water conservation systems such as rainwater harvesting and wastewater recycling in enhancing housing sustainability was performed. The results on Table 4.6 indicates an overwhelming support for the role of water conservation, with a combined 74.2% of respondents agreeing (33.0%) or strongly agreeing (41.2%) with the statement, while only 5.8% expressed disagreement. This strong positive response underscored the importance of integrating water conservation technologies into housing design and policy as a widely endorsed and impactful sustainability measure. The data supported a preposition that resource-efficient infrastructure significantly contributes to sustainability of housing development.

The ensuing analysis revealed that a significant majority of respondents support the notion that green infrastructure like green roofs and urban parks enhances community social well-being and housing sustainability. Specifically, Table 4.6 shows that 74.5% of participants agreed (33.0%) or strongly agreed (41.5%) with the statement, while only 5.0% expressed disagreement. This widespread agreement affirmed the positive role of integrating green infrastructure into urban housing strategies, reinforcing its value as a key component in fostering sustainable and socially vibrant communities.

An analysis of smart home technologies in terms of IoT-enabled monitoring and Building Information Modelling (BIM) in enhancing various aspects of housing sustainability, revealed a relatively strong support. The results on Table 4.6 indicate a broad support for the role of smart home technologies in housing sustainability with, a substantial 74.3% of respondents agreeing (35.4%) or strongly agreeing (38.9%). This underpins the perception that smart technologies significantly contribute to energy efficiency, security, convenience, and maintenance, thereby playing a crucial role in advancing the overall sustainability of housing systems.

An examination of the role of modern construction techniques, including modular housing, Light Gauge Framing Systems (LGFS), and prefabrication in enhancing housing sustainability was undertaken as shown on Table 4.6. A combined 69.9% of respondents agreed (36.3%) or strongly agreed (33.6%), while only 7.3% expressed disagreement. The outcome was interpreted to mean that the respondents clearly recognized the efficiency, reduced environmental impact, and potential cost-effectiveness associated with these innovative building methods, reinforcing their relevance in sustainability of housing development

strategies.

The study analyzed housing design aspects including size, configuration, typology, and materials as critical determinants of housing sustainability. The results displayed on Table 4.6 show a strong consensus with a majority (75.4%) of respondents agreeing (38.9%) or strongly agreeing (36.5%), while only 6.1% expressed disagreement. This outcome depicts the importance of context-sensitive, well-planned housing design in promoting sustainable living environments, supporting the integration of thoughtful architectural choices in sustainability-focused housing policies.

Combining the positive scores for all the indicators on Table 4.6, whereby, 0 = strongly disagree or disagree, and 1 = moderately agree or agree or strongly agree – gives an overall average percentage of 94.56% for the housing design innovations in Kenya. This reflects the respondents' estimation of the probability that the housing policies of Kenya will deliver the sustainability dream to the people. In their opinion, the designs have done very well. They are more adequate than the housing policies, legislation and approaches. The dissenting responses, 5.44%, are a negligible proportion.

4.6 Qualitative Data Analysis of Focus Group Discussion

Following the FGD, the resulting data was subjected to analysis of the participants' dominant themes in the housing sustainability enterprise in Kenya. Additionally, lexical analysis of the data was done for visualization and salience of the themes.

4.6.1 Dominant Themes in the Sustainability of Housing in Kenya

The study scrutinised the qualitative data to thoroughly comprehend the phenomenon of housing sustainability in Kenya, by examining lived experiences, attitudes, and perceptions of key stakeholders in the housing sector, who were the participants in the FGD. Through thematic analysis, key patterns and themes in the data were revealed as shown on Table 4.7 below. In this study, thematic analysis was applied to organize the participants' discussions into themes, facilitating better understanding of differing perspectives among the participants. The analysis process involved transcription of raw data, coding, recognizing recurring patterns, and reclassifying categories of themes, as amplified in standard qualitative data analysis texts, for example McAllum et al. (2019) and Locke et al (2023).

Table 4.7: Major Emerging Themes and Insights/Contributions in Sustainability of Housing

Major Theme	Insights/Contributions
1. Conceptualizing Sustainability of Housing in Kenya	Highlights the need for contextualized and holistic approach to sustainability where all dimensions are mutually reinforcing. Also underscore importance of beyond global standards frameworks that integrate and balance green technologies with social and economic realities bridging environmental science, urban economics, and social policy.
2. Achievements and Gaps in Sustainability of Housing in Kenya	Shows minimal attainment of sustainability with efforts remaining symbolic and unscaled. The country's performance in achieving sustainability of housing rated as below average (i.e.<5) on a scale of 1-10 with informal settlements being symptomatic of systemic failure.
3. Enablers of Sustainability of Housing in Kenya	Recommends institutional collaborations for both public and private sector actors, capacity building and national housing policies alignment and coherence to global and regional frameworks such as SDGs, Africa Agenda 2063 as key enablers.
4. Policy, Institutional Cohesion and Governance for Sustainability of Housing in Kenya	Suggests that effective policy implementation is as crucial as policy formulation emphasizing the importance of strong governance mechanisms, coordinated institutional frameworks, and accountability systems.
5. Innovative Financing Models for Sustainability of Housing in Kenya	Points to a critical need for designing context-specific financing models that incorporate long-term operational and maintenance costs. Also suggest the need to develop innovative economic instruments and subsidy and incentives structures that lower financial barriers, ensuring that sustainability of housing is both accessible and economically viable over its life cycle.
6. Role of Data and Technology in Sustainability of Housing in Kenya	Emphasizes the centrality of data-driven decision-making in policy formulation and urban management. Proposes the need for development of digital tools and analytical frameworks that support effective governance and planning as well as examining the impact of real-time data on policy responsiveness and sustainability of housing.
7. Global Best Practices and Lessons Learnt for Sustainability of Housing in Kenya	Encourages comparative studies and benchmarking that contextualize global best practices within local

	realities in Kenya. From the perspective of policy transfer and adaptation it provides insights on how international experiences can inform locally tailored strategies, highlighting the value of both positive and negative case studies in shaping future policy reforms for enhanced sustainability in housing.
8. Urban Planning, Infrastructure and Integrated Design for Sustainability of Housing in Kenya	Underlines the theoretical and practical necessity for integrated urban planning as a foundation for sustainability in housing. Also emphasizes on holistic city planning models such as transit-oriented development and the impact of urban infrastructure on housing sustainability outcomes, emphasizing the need for coordinated spatial planning.
9. Recommendations and Strategic Directions for Sustainability of Housing in Kenya	Underscores the need for intentionality in development of sustainability of housing programmes, effective planning, innovative finance mechanisms and governance reforms towards sustainability of housing.

Amplification of the nine major themes emerging from the participants' responses to the research questions, is as follows: -

Theme 1: Conceptualizing Sustainability of Housing in Kenya

Participants converged around the conceptualization of sustainability of housing as multidimensional emphasizing on the need for clarity on what constitutes sustainability of housing as shown in Table 4.7. The consensus was that sustainability must be multidimensional, integrating environmental stewardship, economic affordability across the lifecycle of buildings, and social inclusivity. The discourse revealed a tension between sustainability ambition and actualization, where policy definitions are broad, but implementation lacks precision and consistency. They observed that Kenya lacked a clear and standardized nationally accepted definition or framework and therefore urged for measurable, context-specific indicators encompassing all dimensions of sustainability. One participant said,

> **"We should not just be collecting data on how many houses there are in Kenya, but how many people need two-bedroom houses in Kayole Estate... that's the intentionality of the data we need." (Participant A, FGD, April 2025).**

There was a call for localizing sustainability definitions and metrics, considering Kenya's diverse socio-ecological zones. Dimensions of sustainability included the following: First, *Environmental Dimension:* Participants underscored the importance of environmental stewardship in sustainability of housing development. They observed that sustainability of housing must incorporate innovative environmentally friendly designs, such as adoption of green building codes and standards, water harvesting, renewable energy sources, and waste management strategies. The discussants emphasized that sustainability cannot be achieved by merely constructing "green" buildings unless a broader environmental stewardship such as integrated urban planning is in place. A case in point is a discussant who said that,

> **"For example, the projects we have is like a drop in the ocean because you have a building maybe in town, it's only one building certified as green while the rest are not green. So, at the end of the day, the building is still pouring to the same sewerage system. And still using the same infrastructure. So then, yes, it's a sustainable building not within a sustainable wider plan. So, I think our planning versus a better spatial planning will be a factor that could enhance achievement in sustainable housing..." (Participant B, FGD, April 2025).**

Second, *Economic Dimension*: The discussants highlighted the importance of life cycle costing of housing units. The affordability challenge was linked to both initial construction and long-term operational and maintenance costs. The stakeholders emphasized that sustainability comes with a "green premium" that could limit the uptake by lower-income earners, stressing that economic sustainability should include effective financing models, subsidies, tax and credit incentives that enable affordability and maintenance of public housing. Third, *Social Dimension*: The social sustainability of housing was discussed in the context of addressing informal settlements, promoting social cohesion, and ensuring inclusive access to amenities. The discussants questioned whether current housing developments truly meet the needs of target beneficiaries and whether the broader social infrastructure such as schools, transport, green spaces, and communal areas are in place to support lived experiences.

Theme 2: Achievements and Gaps in Sustainability of Housing in Kenya

It was observed that despite institutional progress such as the adoption of the new Building Code 2024, adoption of IFC EDGE certification and other green building rating tools, Kenya was still at

nascent stage especially in sustainability of public housing. While several sustainability initiatives by key players of housing development spanning policy makers, regulators, implementing agencies, financiers, contractors, professional bodies, Kenya Green Building Society among others were highlighted, discussants assessed the country's performance in achieving sustainability in housing as "below average", rating it below 5 on a scale of 1 - 10 (10 being the highest score) with incidence of informal settlements and slums being symptomatic of systemic failure, as displayed on Table 4.7.

Theme 3: Enablers of Sustainability of Housing in Kenya

The panelists discussed a wide array of enablers of sustainability of housing in Kenya. The discussants noted that public housing development policy initiatives such as the affordable housing program were well aligned to global policies such as the UN Sustainable Development Goals SDG the Africa agenda 2063, Vision 2030, The National Urban Development Policy among other policy framework, as shown on Table 4.7. In addition, capacity building integrating sustainability into education and professional training was highlighted as a key enabler. The role of collaborative and strategic initiative such as private public partnership by institutions such Kenya Green Building Society, Architectural Association of Kenya was seen as a step in the right direction in driving sustainability in housing. Further the Focus Group noted the initiative to develop a localized green rating tool that is the Safari Green Building Index would yield more contextualized indices for measuring housing sustainability in Kenya. A discussant observed that,

> **"If sustainability was mainstreamed in our training curricula and professional CPDs, it would have more uptake." (Participant C, FGD, April 2025).**

Theme 4: Policy, Institutional Cohesion and Governance for Sustainability of Housing in Kenya

The panelists discussed a wide array of inhibitors of sustainability of housing in Kenya from a policy, institutional cohesion and governance perspective, as summarized on Table 4.7. First, policy and regulatory frameworks for enhanced implementation of sustainability in housing was highlighted. It was argued that, although a robust legal framework exists (e.g., the National Building Code, various housing policies, and urban development guidelines), the challenge remains in effective implementation. Many participants opined a huge overlap of laws, fragmented institutional responsibilities and lack of coherent governance structures.

Secondly, effective institutional coordination, remains a major gap in sustainability of housing development in Kenya. The focus group stressed that housing policies, despite being well articulated on paper, suffer from a silo approach in implementation. The absence of an overarching institution dedicated to overseeing sustainability of housing was frequently mentioned, along with calls for integrated planning that aligns urban development design and land use with environmental goals.

Thirdly, governance models and accountability structures remain a major deterrent in realizing housing sustainability in Kenya. Some members of the focus group made the case that sustainability of housing is fundamentally a governance issue. They opined that without a streamlined coordination among the major players in housing such as the Ministry of Lands, Public Works, Housing and Urban Development, implementing agencies for instance National Housing Corporation, Affordable Housing Board, county governments, and regulatory agencies, sustainable practices are easily compromised. Further, the need for transparent data collection, evidence-based decision-making, and long-term planning was seen as crucial to hold institutions accountable and to manage public housing effectively. Fourth, socio-cultural and behavioral challenges were identified as barriers to sustainability in existing housing schemes. In some instances, this is characterized by low community cooperation in estate management, maintenance and adherence to estate regulations risking safety and social cohesion.

Lastly, the cost of sustainability spanning expensive and bureaucratic approval systems, was associated with making large-scale sustainability elusive. In addition, green premiums associated with sustainable technologies were viewed as a barrier to their adoption, particularly for low-income housing development further driving social exclusion of vulnerable households. Further analysis using Linear Latent Dirichlet Allocation (LDA) thematic analysis showed a clear dominance of Policy, Institutional Cohesion and Governance as an anchor theme across most questions of the discussion.

Theme 5: Innovative Financing Models for Sustainability of Housing in Kenya

Several discussants introduced the idea of alternative financing models, such as green financing, public–private partnerships, and innovative mechanisms that use revenue generated from ancillary services (for example, bundling utilities with housing) to subsidize maintenance and related service charge costs, as displayed on Table 4.7. The discussion yielded international examples, suggesting

that Kenya could learn from models in Singapore, Japan or South Africa where financing instruments are designed to cross-subsidize and incentivize housing development and to ensure affordability over the housing life cycle. For example, interest rates on housing development finance were noted to be lower for developers proposing CASBEE Green Rated houses in Japan. One participant said,

> **"A lot of good public housing maintenance, like Singapore, have gone back to regionalization, you give it to counties to maintain. They will develop a federal national government maintenance program on public housing. You cannot leave it in the hands of service charge. It will not work because they will not pay. And if you look at what Singapore did, once the people that are on the lower barrel of their housing cannot pay them because it's mixed use, they are cushioned by those who have within their houses." (Participant D, FGD, April 2025).**

However, it was noted that financial institutions in Kenya including development partners have structured and incorporated green financing, but this is still at a nascent stage of adoption. In this connection, development or localization of a standardized and commonly accepted green rating tool will be required in Kenya to facilitate sustainability of housing finance. It was observed that the relationship between sustainability efforts, affordability and livelihoods outcomes are complex. Sustainable design features increase upfront costs, but when integrated well, can reduce long-term expenditure from a lifecycle cost perspective. However, unintended consequences were also noted by a discussant who said,

> **"We put up houses for the slum people, but they didn't stay in them. They rented them out. So, we didn't change lives." (Participant E, FGD, April 2025).**

Theme 6: Role of Data and Technology in Sustainability of Housing in Kenya

The discussants highlighted the need for robust data collection and management systems capable of informing decision-making for sustainability in housing, as captured on Table 4.7. Intentionality in data collection was emphasized where quantitative (e.g. number of housing units and occupancy rates) and qualitative (e.g. maintenance costs, environmental impact, and community satisfaction) aspects are tracked simultaneously. Digitalization strategies such as integration of early warning systems for disaster risk management, real-time monitoring of infrastructure, and the use of digital databases to inform future urban and housing policies were proposed. Finally, the emphasis was

placed on how the lack of coherent, real-time data disrupts policy formulation. Data-driven insights are seen as pivotal in ensuring that public housing not only meets immediate demands but also remains viable and sustainable over decades (policy coherence through data).

Theme 7: Global Best Practices and Lessons Learnt for Sustainability of Housing in Kenya

Resulting from the focus group discussions was a comparison of Kenyan housing practices with some of the globally considered best practices such as Singapore, South Africa, Finland, and Japan. There was consensus that Kenya has some of the regulatory frameworks and policy tools in place, it lags in cohesive implementation and the adoption of innovation for sustainability housing practices as shown on Table 4.7.

Further, the discussion advocated not only for emulation of best practices but studying global failures in public housing to avoid repeating similar mistakes in Kenya. The argument was that a deliberate focus on what has gone wrong ranging from unsustainable maintenance practices to fragmented governance could yield valuable lessons for future policy reforms. In addition, the need to contextualize global best practices to the Kenyan socio-economic, cultural, and environmental realities was emphasized. For example, while green building certifications and integrated urban planning have worked elsewhere, their effective adoption in Kenya requires a careful calibration of policies that consider local affordability, social dynamics, technology and material availability. Mwambalazi Village in Kwale was cited as a promising local example for grassroots social cohesion and coexistence. In addition, discussants recommended that players in housing development in Kenya, should focus on the following countries for the following specific lessons:

First, Singapore: Effective estate maintenance, integrated planning and service-charge subsidy model.

Second, Belgium: Attractive social housing guarantees based on human dignity.

Third, Japan: Intentional data-driven planning (e.g., based on CASBEE).
Fourth, South Africa and Rwanda: State-led integration and large-scale delivery.

Fifth, Germany: Land use planning and transportation systems.

Theme 8: Urban Planning, Infrastructure and Integrated Design for Sustainability of Housing in Kenya

Many focus group members underscored the importance of urban regeneration plans that integrate

housing with transportation, commercial spaces, and green areas. The lack of comprehensive planning in Kenya, was identified as a root cause of many sustainability challenges, from congested infrastructure to the rapid deterioration of once-model housing, as shown on Table 4.7. For instance, Buruburu estate in Nairobi was cited as a case study that would serve as cautionary tale of the failure to maintain integrated urban planning resulting in a breakdown of public amenities, deteriorated social cohesion, and inefficient service delivery.

Further, the discussants argued that even when sustainability of housing units are built, the supporting infrastructure (such as roads, sewer systems, public spaces) is insufficient or poorly planned, leading to long-term degradation and diminished quality of life for residents. This was termed as an infrastructure mismatch that could lead to decline in community-oriented housing models and a shift from communal living to individualized cage-like structures. A discussant is quoted as saying,

> **"We don't think about how they function. We don't think about their cohesion. We don't think about social infrastructure and whether you look at schools, hospitals, and so on in relation to these areas. We don't look at their religious practices and so on." (Participant F, FGD, April 2025).**

Theme 9: Recommendations and Strategic Directions for Sustainability of Housing in Kenya

To enhance sustainability, the discussants gave the following proposals as recommendations and strategic directions that actors Kenya should intentionally pursue to drive sustainability in housing as summarized on Table 4.7: First, redefining the housing programs by re-orienting them from purely affordability-centric to a sustainability-driven framework encompassing on environmental, social and economic paradigms. Second, integrating urban planning with a view to anchor housing in broader infrastructure development within town master plans. Third, structuring sustainable financing through government-backed service charge subsidies, accessible and affordable long-term finance options, and green bonds. Fourth, implementing data collection and management systems capable of generating real-time, geospatial, and demographically sensitive databases. Fifth, mainstream social sustainability focus on housing design for community interaction, mobility, inclusion and dignity of everyone.

4.6.2 Alignment of Respondent Themes with Research Objectives

An alignment of the themes to the specific research objectives was attempted and the results displayed on Table 4.8. The alignment of thematic insights emerging from the Focus Group Discussion (FGD) to the study's objectives validates the research focus and strengthens the findings. Table 4.8 shows that Theme 1: Conceptualizing Sustainability of Housing in Kenya is aligned with Objective (i), which seeks to assess the level of sustainability.

This theme underscores the foundational understanding of what sustainability means to key stakeholders in Kenya's housing sector, including environmental, social, and economic dimensions. It sets the stage for evaluating existing efforts and measuring progress.

Table 4.8: Alignment of Thematic Areas with Research Objectives

Theme	Aligned Objective(s)	Justification
Theme 1. Conceptualizing Sustainability of Housing in Kenya	i	Helps in understanding how stakeholders define and perceive sustainability in housing, crucial for assessing its current level.
Theme 2. Achievements and Gaps in Sustainability of Housing in Kenya	i	Provides a direct assessment of achievements and gaps, informing the current status of housing sustainability.
Theme 3. Enablers of Sustainability of Housing in Kenya	i, ii, iv	Highlights facilitating factors including policies, partnerships, and strategies that enhance sustainability.
Theme 4. Policy, Institutional Cohesion and Governance	ii, iii	Examines the effectiveness of policy and legal frameworks, and institutional coordination in driving housing sustainability.
Theme 5. Innovative Financing Models	ii, iv	Evaluates how financing mechanisms support or hinder sustainable housing policies and approaches.
Theme 6. Role of Data and Technology	v	Focuses on innovations like smart tech and data systems that support sustainable housing design.
Theme 7. Global Best Practices and Lessons Learnt	ii, iii, iv, v	Provides comparative insights from global contexts to inform improvements in Kenya's housing policies, laws, and designs.
Theme 8. Urban Planning, Infrastructure and Integrated Design	iv, v	Explores spatial planning, infrastructure, and design integration as contributors to sustainable housing.

Table 4.8 shows that Theme 2: Achievements and Gaps in Sustainability directly supports Objective (i) as it uncovers practical outcomes and shortcomings in housing sustainability. It presents empirical insights into what has been accomplished and the challenges still facing the sector, providing a clear picture of current sustainability levels. Theme 3: Enablers of Sustainability connected with Objectives (i), (ii), and (iv). It identifies critical drivers of sustainability such as policy alignment, institutional partnerships, and capacity-building strategies. This reflects how

supportive ecosystems contribute to housing sustainability from multiple angles, conceptual, legislative, and practical implementation.

Theme 4: Policy, Institutional Cohesion, and Governance is aligned with Objectives (ii) and (iii). It critically examines the effectiveness of policy frameworks and governance structures in delivering sustainable housing. This theme reveals policy fragmentation and institutional silos as significant barriers, highlighting the need for coordinated and coherent governance. Theme 5: Innovative Financing Models aligns with Objectives (ii) and (iv) by evaluating how financial tools and economic incentives can either advance or hinder sustainable housing. It emphasizes the role of financing in translating policies into tangible housing outcomes, especially for marginalized populations. Table 4.8 shows that, Theme 6: Role of Data and Technology is directly related to Objective (v), focusing on how digital tools, smart technology, and data-driven decision-making can improve the design, monitoring, and efficiency of sustainable housing initiatives.

Theme 7: Global Best Practices and Lessons Learnt intersects with Objectives (ii), (iii), (iv), and (v). It provides comparative insights and international benchmarks that can inform policy refinement, legal reforms, design improvement, and implementation strategies in Kenya. Theme 8: Urban Planning, Infrastructure, and Integrated Design supports Objectives (iv) and (v), by emphasizing spatial planning, urban infrastructure, and the integration of design principles as core contributors to housing sustainability.

4.6.3 Lexical Analysis for Visualization and Salience in Themes

Three approaches were applied in lexical analysis for visualization of themes for Word Importance (Frequency and Prevalence), Word Tree and Word Cloud for Positive Sentiments.

Word Importance: Frequency and Prevalence

The word cloud in Figure 4.8 highlighted that the most frequently mentioned words in the focus group discussion to include housing, people, think, sustainability and building, which suggested a strong people focus on housing issues and reflective thoughts in sustainable development. The prominence of words like affordable, social, government, planning and public in Figure 4.3 further suggests policies related to housing should address themselves to the accessibility and community welfare in the Kenyan context as shown by the prevalence of the words “Kenya" and "country."

Environmental considerations were visually evident through terms like green, sustainable, and practices, pointing to a growing awareness of sustainable design and urban planning. The dominance of the words "housing", "think", "people" and "sustainability" in Figure 4.3 below suggests that when thinking about housing sustainability programmes the focus should be on the inclusivity of people.

Figure 4.8: Word Importance: Frequency and Prevalence

Word Tree from Sustainability of Housing Discussions

The Word Tree in Figure 4.8 on Sustainability of housing discussions revealed a multifaceted understanding of the themes, centering on sustainable and related concepts like economically affordability, green building, and social impact, with key clusters emerging around policy, institutions, governance, eco-design, and social equity among others. Interconnected words highlighted discussions on the economic viability of sustainable development, challenges in implementation, and the specific context of Kenyan housing policies, while notable connections linked affordability to global challenges and corporate governance to social responsibility.

The word tree in Figure 4.8 also underscored implementation gaps, that fragmented private-sector roles, and the need for integrated policies, stronger rural inclusion, and clearer sustainability certifications, emphasizing the importance of balancing environmental considerations with social and economic factors in achieving sustainability of housing, and suggesting a need for further investigation into specific challenges and policy implications in Kenya.

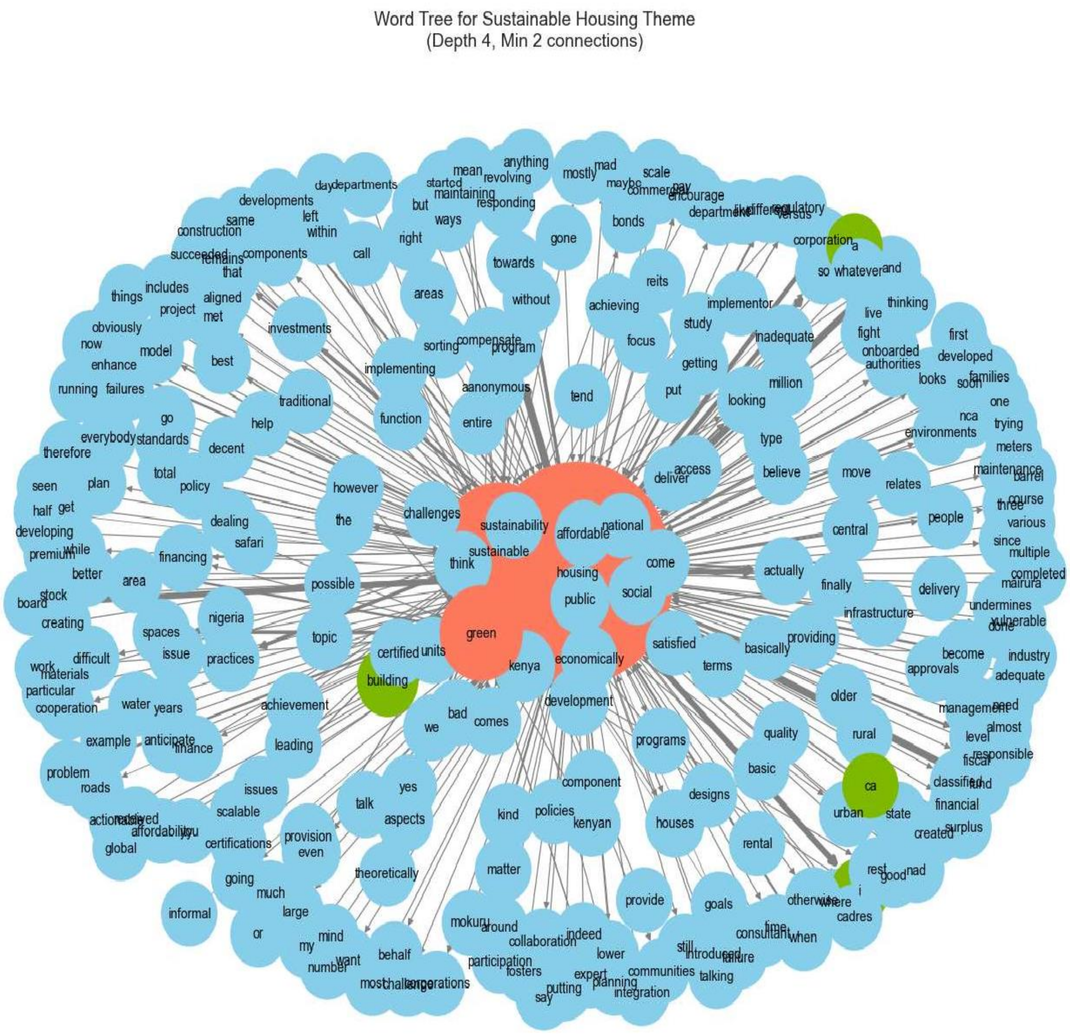

Figure 4.9: Word Tree from Sustainability of Housing Discussions

Word Cloud for Positive Sentiments from Sustainability of Housing Discussion

The Positive Sentiments Word Cloud in Figure 4.9 depicts a landscape dominated by terms like people, housing and Kenya, all appearing with significant size and prominence, indicating their frequent association with positive sentiments within the analyzed text. The cloud revealed a thematic focus on conceptualization of sustainability (from an environmental, social and economic standpoint), emphasis on urban development issues, in relation to Kenya, with words like sustainability, development, Nairobi City appearing alongside positive descriptors such as good, right and better. This suggested that discussions surrounding sustainability of housing development in the Kenyan context, were framed with a generally positive outlook, emphasizing community

(people), practical action ("actually," "make"), and forward-looking concepts (sustainability, development). The inclusion of terms like issue and challenge, though not inherently positive, implied that these topics were addressed constructively, with a focus on solutions and positive outcomes. In summary Figure 4.10 shows that people are at the center of sustainability in housing and therefore initiatives in the housing sector should be people centric looking at their economic, social and environmental wellbeing.

Figure 4.10: Word Cloud for Positive Sentiment from Sustainability of Housing Discussion

4.7 Conclusion

In a nutshell, sustainability of housing in Kenya remains below average. This is because the driving forces – particularly, housing policies, housing legislations, housing approaches and housing designs - do not operate effectively. Although the policies, legislations, approaches and designs portray high probabilities – of above 60% - to cause housing sustainability, their combined probability is low, 32%. This is obtained by getting the product of the four probabilities and is corroborated by the sentiments of the FGD participants, because ideally the factors should work interdependently. According to the questionnaire respondents, none of the

four determinants is 'fully' adequate to drive the housing sustainability enterprise in the country. Additionally, synergy amongst the determinants appears to be poor. This suggests a better institutional framework and capacity enhancements.

CHAPTER FIVE: SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the study conclusions and recommendations. It starts by recapitulating the study findings for each of the research objectives separately. Thereafter, the study conclusions and recommendations are presented. Finally, suggestions for areas of further research are given.

5.2 Summary of Findings

In this study, the extent of housing sustainability and factors that influence it in Kenya was investigated. Data collected from checklist observation, survey questionnaire and FGD were analyzed using various methods. A summary of the data analysis results is as follows: -

5.2.1 Level of Sustainability of Housing in Kenya

The first objective of this study sought to assess the level of sustainability of housing in Kenya. Statistical analysis of site observation data revealed that most of the ongoing housing projects exhibited commendable adherence to regulated sustainability criteria, particularly in environmental performance and safety/compliance measures. Projects were notably successful in implementing environmental impact mitigation strategies, optimizing site layout for views and natural ventilation, and maintaining regulatory compliance with safety protocols and building codes. This performance likely reflects the influence of formal regulations and adherence to mandatory development standards which are closely monitored by government institutions. Despite strong environmental compliance, the integration of design-based and technology-driven sustainability features remained notably low. For instance, smart home technologies were entirely absent and innovative construction methods and the use of sustainable or recycled materials each received very low responses. The lack of adoption in these areas suggests a limited diffusion of contemporary green building innovations and possibly cost-related constraints or inadequate technical expertise among developers.

The observed high variability in performance across sites and categories underscores an uneven implementation landscape, where some projects like Embu AHP demonstrate commendable sustainability integration, while others like Soweto and Ruiru fall significantly short. This

disparity, confirmed by statistically significant differences, highlights the influence of site-specific factors, including project management capacity, local leadership, and institutional support. Notably, the lack of smart technologies, low use of sustainable materials, and poor landscape integration point to missed opportunities for innovation and long-term sustainability planning. Moreover, the weak performance in economic sustainability signals the need for policy shifts that prioritize lifecycle cost analysis, affordability, and long-term maintenance in housing design and delivery. Overall, sustainability achievement observed in ongoing projects was rated at 66.40%, which was only slightly above average, and which is relatively low. Accordingly, a considerable portion of affordable housing development in Kenya remains unsustainable.

The findings based on site visit align with those of Gan et al. (2017), who emphasized that sustainability of housing should address both environmental and social challenges by integrating eco-friendly construction methods with affordability. They highlighted that sustainability of housing should not only focus on cost-effectiveness and environmental considerations but also ensure a decent standard of living for residents needs that, while fundamental, may not be easily quantified economically. Consequently, sustainability of housing encompasses three critical dimensions: environmental, economic, and social sustainability.

The site visit findings substantiate the theoretical framework of gentrification, which elucidates the transformation of urban neighborhoods through the influx of higher-income individuals into previously lower-income areas. This process often precipitates the displacement of existing residents and alters the community's socioeconomic composition and cultural identity. As delineated by Ruth Glass in 1964, gentrification involves the migration of affluent populations into working-class neighborhoods, leading to increased property values and the eventual displacement of original inhabitants. The observed changes during the site visits reflect these dynamics, highlighting the complex interplay between economic investment, residential mobility, and community transformation inherent in gentrification processes.

Analysis of the FGD data led to the extraction of Theme 1: *Conceptualizing Sustainability of Housing in Kenya.* This theme is aligned with Objective (i), which seeks to assess the level of sustainability. The theme underscores the foundational understanding of what sustainability means to key stakeholders in Kenya's housing sector, including environmental, social, and

economic dimensions. It sets the stage for evaluating existing efforts and measuring progress. The participants observed that Kenya lacked a clear and standardized nationally accepted definition or framework of sustainability of housing and therefore urged for measurable, context-specific indicators encompassing all dimensions of sustainability. Theme 2: *Achievements and Gaps in Sustainability* directly supported Objective (i) as it uncovers practical outcomes and shortcomings in housing sustainability. It presents empirical insights into what has been accomplished and the challenges still facing the sector, providing a clear picture of current sustainability levels.

The housing site visit analysis highlights a dual reality, that while significant progress has been made in environmental compliance and site planning, critical gaps persist in economic, technological, and design-based dimensions of sustainability. The disparities in projects and category performance (sustainability criteria) underscore the need for policy reform, capacity building, and incentivization of innovation and inclusivity in housing development. Ultimately, advancing sustainability in Kenya's public housing sector requires a shift from compliance-driven approaches to integrated, multidimensional strategies that are both people-centered and future-oriented.

The FGD findings align with Smith (2023) observation that environmental sustainability in housing focuses on reducing the ecological footprint of residential buildings. This is achieved through the adoption of energy-efficient practices, resource conservation, and waste reduction strategies. Key approaches include the use of eco-friendly materials, such as recycled or sustainably sourced products, and the implementation of passive design techniques that enhance natural lighting and ventilation. Innovative construction methods, like green roofs and energy-efficient windows, further contribute to minimizing environmental impact. Collectively, these practices emphasize the importance of integrating green building techniques, thoughtful material selection, and sustainable design to promote environmental stewardship in housing development.

The FGD outcome aligns with Ullah's (2024) perspective that economic sustainability in housing necessitates a comprehensive integration of economic viability, environmental stewardship, and social equity. This multifaceted approach is essential to address the growing demand for affordable housing while ensuring long-term benefits for communities and the

environment. Key components of this approach include supportive governmental policies, the adoption of innovative practices, and the establishment of robust public-private partnerships. Such a holistic framework ensures that housing developments are not only economically feasible but also environmentally responsible and socially inclusive, thereby contributing to sustainable urban growth.

The FGD discoveries align with Makalima (2024) perspective that social sustainability in housing is a multifaceted concept emphasizing the quality of life within communities. This encompasses fostering social interactions, inclusivity, and community cohesion. Makalima (2024) underscored that social sustainability is a critical pillar of sustainable development, alongside environmental and economic sustainability. Creating environments that promote social relationships, provide psychological comfort, and enhance community building is essential. This can be achieved through the integration of informal social spaces, such as meeting places, religious sites, and areas for informal enterprises, which are crucial for enhancing social sustainability. These spaces promote social interactions and cohesion, contributing to establishing social capital within neighborhoods.

5.2.2 Contribution of Housing Policies to Sustainability of Housing in Kenya

Under the second research objective the study sought to determine the extent to which the existing housing policies have contributed to sustainability of housing in Kenya. Statistical analysis of questionnaire data reveals that existing housing policies in Kenya are perceived as rather ineffective in promoting sustainability of housing development, with particular deficiencies in public engagement, maintenance frameworks, and the impact of flagship programs like AHP. Similarly, the outcome of correlation analysis showed a positive significant correlation between the housing policies and adoption of innovative designs, which meant that an integrated system of policies, creates a conducive environment for the adoption of innovative housing designs, an essential ingredient for achieving sustainability of housing development. These findings underline the need for policy reform that emphasizes participatory planning, integrated urban strategies, and enhanced program performance tracking to align with sustainability goals.

The findings on housing policy as a significant contributor to housing sustainability align with the work of Ondola et al. (2013). Their study revealed that the Kenyan government's approach to

housing has been characterized by a lack of prioritization, inadequate guidance for regional and local housing initiatives, and insufficient integration of housing policies with broader economic, social, and environmental objectives. Additionally, they identified shortcomings in policy and subsidy frameworks, as well as ineffective implementation strategies, all of which hinder the development of sustainability of housing solutions. The findings on housing policy align with the study by Waziri and Roosli (2013), who emphasized that effective housing policies should encompass broad coverage, ensure sustainability through inclusive implementation, and prioritize public participation. They highlighted that involving the public in policy formation is crucial for accommodating cultural considerations and aligning with prevailing housing norms, thereby enhancing the effectiveness and acceptance of housing policies.

The empirical findings on housing policies and the sustainability of housing are consistent with the objectives outlined in Kenya's housing policy framework, as detailed in the National Housing Corporation (NHC) 2023-2027 Strategic Plan. The policy aims to address the country's escalating housing challenges, particularly the significant gap between housing demand and supply in metropolitan areas. The policy's primary goal is to make housing, essential services, and infrastructure accessible to the impoverished, thereby promoting a healthy lifestyle. The NHC's strategic plan emphasizes increasing the housing supply, promoting home ownership through affordable financing options, and fostering community development. It highlights the importance of integrating housing policies with broader economic, social, and environmental goals to ensure sustainability. Furthermore, the plan identifies key housing policies and legislative frameworks that support these objectives, including: The Constitution of Kenya (2010), Architects & Quantity Surveyors Act, Cap. 525, Engineers Act of 2011, Community Land Act No. 27 of 2016, Environmental Management and Coordination Act (EMCA) No. 8 of 1999, National Construction Authority Act No. 41 of 2011, Physical Planning Act No. 6 of 1996, Survey Act Cap. 299, Water Act No. 43 of 2016, National Housing Policy (2004, Revised 2016), Affordable Housing Programme (AHP) under the Big Four Agenda (2018), Kenya Vision 2030 (Housing Component) , National Urban Development Policy (NUDP, 2016) and Slum Upgrading Policy. These policies collectively aim to create a comprehensive framework that addresses the multifaceted aspects of housing in Kenya, ensuring that housing development is inclusive, sustainable, and aligned with national development goals.

The findings on housing policies align with the principles of Innovation Diffusion Theory (IDT), which emphasizes the importance of communication and social systems in the adoption of new ideas. In the context of sustainability of housing in Kenya, effective communication and knowledge sharing among project designers, managers, policymakers, and residents are crucial. This collaborative approach facilitates the dissemination and adoption of sustainability of housing practices, ensuring that innovations in housing are understood, accepted, and implemented effectively within the community.

From the FGD, Theme 3: *Enablers of Sustainability* connects with Objectives (i), (ii), and (iv). It identifies critical drivers of sustainability such as policy alignment, institutional partnerships, and capacity-building strategies. This reflects how supportive ecosystems contribute to housing sustainability from multiple angles conceptual, legislative, and practical implementation.

From Theme 3: enablers of sustainability of housing in Kenya, it was observed that there exists a strong alignment between Kenya's national housing strategies such as the Affordable Housing Programme (AHP) and international development frameworks including the UN Sustainable Development Goals (SDGs), Agenda 2063, and Kenya Vision 2030. This alignment underscores the country's commitment to global sustainable development targets and provides a strategic foundation for embedding sustainability in housing at both policy and implementation levels. Conversely it was noted that there remains a significant disconnect between policy design and effective implementation. Policies like the Affordable Housing Programme were highlighted for their intent, particularly in addressing access and affordability.

One of the prominent enablers identified was capacity building through integration of sustainability into education and professional training. This highlights the importance of equipping current and future housing related professionals with the knowledge, tools, and mindset required to design and deliver sustainable housing solutions. This directly supports the study argument that institutional capacity and human resource development are essential for operationalizing sustainable design strategies and scaling them across the housing sector.

The role of collaborative and strategic partnerships, particularly through public-private partnerships (PPPs), emerged as another crucial enabler. The Kenya Green Building Society (KGBS) and the Architectural Association of Kenya (AAK) were cited as leading examples of how sectoral collaborations can enable innovation, knowledge exchange, and technical capacity

to support sustainable housing practices. Partnerships orchestrated by these institutions serve as platforms for stakeholder convergence, promoting shared objectives and co-investment in sustainable urban development.

Additionally, the ongoing development of a localized green rating system, notably the Safari Green Building Index, was noted as a key step towards contextualizing sustainability metrics in Kenya's housing sector. The focus on locally relevant indicators reflects a shift from adopting generic international standards to creating evaluation tools that respond to Kenya's unique environmental, social, and economic realities. This move not only enhances the credibility and applicability of sustainability assessments but also shows the importance of contextual innovation and policy localization in sustainable housing development.

In sum, Theme 3 reinforces the need for multi-level alignment ranging from global frameworks to local policies, professional training, stakeholder collaboration, and contextual innovation as vital to creating an enabling environment for sustainable housing in Kenya. These enablers bridge the gap between policy ambition and on-the-ground implementation, setting the stage for more inclusive, resilient, and environmentally conscious urban development.

The thematic analysis outcomes were corroborated with quantitative analysis, where the MCT analysis results identified housing policies as a crucial component to sustainability of housing. The weighted mean score of housing policies specifically, revealed a moderate to low level of agreement amongst the respondents indicating that stakeholders view current housing policies as less than sufficiently effective in advancing sustainability goals. The key contributors to housing policies based on the mean score analysis were identified as; National housing policies have significantly enhanced sustainability of housing, Public-Private Partnerships and the National Urban Development Policy, Affordable Housing Programme, Public participation in policy development, building maintenance policy effectiveness and Government policy adequacy, respectively.

5.2.3 Contribution of Housing Legislation to Sustainability of Housing in Kenya

The second research objective sought to find out the extent to which the existing housing legislations have contributed to sustainability of housing in Kenya. Statistical analysis of questionnaire data indicated a moderately positive perception of the overall effectiveness of existing housing legislation in promoting sustainability of housing. This suggests that while

notable progress has been made, significant gaps remain, particularly in areas such as affordability, environmental sustainability, and social inclusivity within the current legal framework. The highest-scoring variables were building codes that enforce sustainability standards and the availability of adequate capacities (managerial, material, technical, and human skills) to support sustainability of housing. These results reflect a relatively strong institutional and technical foundation, suggesting that stakeholders perceive these elements as more developed or better understood. Conversely, variables such as the presence of adequate institutions, and the existing framework of laws and regulations were rated moderately, indicating average levels of satisfaction with institutional strength and legal coherence.

The lowest-rated elements included the Public-Private Partnership (PPP) Act, housing development legislation (e.g., Housing Act Cap. 117, NCA Act of 2011, and Affordable Housing Act of 2024), and land use legislation (e.g., Land Act, Urban Areas and Cities Act). These findings indicate a perception that these legal instruments are either less effective or insufficiently aligned with sustainability objectives. In particular, the low score for the PPP Act suggests that although the policy exists, its practical impact on sustainability of housing in Kenya remains limited. In general, the results point to a partial alignment between current legal and institutional frameworks and sustainability goals. To fully realize the potential of sustainability of housing development, targeted reforms are needed, particularly in land use legislation, policy integration, and implementation mechanisms.

The study results substantiate the position taken by Muigai (2019) and NHC (2023) who identified the major weakness of the Kenyan building Code of 1968 as lack of emphasis on sustainability and affordability, which are now central to contemporary housing policy. The studies note that the Kenyan Building Code of 1968 has long served as the primary regulatory framework for construction standards and building safety in the country. Originally developed during the colonial era, the Code was modeled after British standards and had remained largely unchanged for decades. It provided guidelines on structural design, fire safety, sanitation, ventilation, and building materials. However, scholars and policy analysts have criticized the Code for being outdated and ill-suited to Kenya's current social, economic, and environmental realities. However, it was observed that Kenya has since ushered in a new Building Code 2024 which came to effect in March 2025 and, therefore, the Code's contribution to sustainability of housing is yet to analyzed.

The findings on housing legislation are consistent with those of Bucha et al. (2020), who highlighted several legislative gaps in Sessional Paper No. 3 of 2016. These gaps include challenges in accessing affordable housing finance, largely due to high interest rates, strict documentation requirements, and the lack of adequate collateral. Additionally, the government has faced difficulties stemming from outdated regulations, weak institutional frameworks, and insufficient support for housing programs. Similarly, the study findings align with Kenya's Vision 2030, a long-term development blueprint aimed at transforming the country into a newly industrialized, middle-income nation with an improved quality of life for all by the year 2030. The housing agenda falls under the Vision's Social Pillar, which emphasizes enhancing the quality of life through key social sectors, including housing and urban development (GoK, 2007).

The FGD recognized legislation such as the newly adopted 2024 Building Code and frameworks around green building certifications like EDGE as significant institutional milestones. However, participants collectively assessed the implementation and enforcement of such legislation as weak, rating Kenya's performance in sustainability of housing as "below average." Notable results of the FGD were the extraction of Theme 4, that centers on policy, institutional cohesion and governance for sustainability of housing in Kenya. In addition to Theme 4, Theme 7: Global Best Practices and Lessons Learnt intersects with Objectives (ii), (iii), (iv), and (v). It provides comparative insights and international benchmarks that can inform policy refinement, legal reforms, design improvement, and implementation strategies in Kenya.

The findings under Theme 4 highlight the critical role that governance structures, institutional synergy, and coherent policy frameworks play in shaping the sustainability trajectory of housing development in Kenya. The discussion revealed that while Kenya has made commendable progress in establishing a robust legal and policy framework such as the National Building Code and various housing and urban development policies their potential impact is significantly hampered by challenges in enforcement and institutional fragmentation. This gap between legal framework formulation and execution emerged as a recurring concern across the focus group discussion.

A major insight from the FDGs related to the lack of institutional cohesion**,** which manifests through overlapping mandates, silo operations, and absence of a central authority to oversee and coordinate sustainability efforts in the housing sector. This institutional disintegration has led to duplication of roles, inefficiencies, and a weakened policy response to emerging urbanization and housing pressures. This aligns directly with the 's proposition that governance effectiveness and institutional coherence are indispensable enablers of sustainable housing outcomes. Moreover, participants emphasized that governance and accountability are not just administrative concerns but foundational pillars of sustainable development. Without strong inter-agency collaborations among entities such as government ministries and departments, implementing agencies, county governments, regulatory bodies and other key stakeholders in housing development, the integration of sustainability principles into planning, financing, construction, and management processes remains superficial. The absence of reliable data systems and long-term planning frameworks was also seen as a barrier to transparency, accountability and evidence-based decision-making, thereby reducing public trust and undermining the legitimacy of housing initiatives.

The study also surfaces socio-cultural and behavioral dynamics as often-overlooked dimensions of legislation and governance in housing in Kenya. Weak estate governance, low community participation, and non-adherence to communal norms were identified as risks to the sustainability of already established housing schemes. These behavioral aspects underscore the need for participatory governance models that prioritize civic engagement and promote shared responsibilities in estate management.

Lastly, the FDG pointed to cost-related legislative barriers**,** including bureaucratic approval systems and the "green premium" associated with sustainable construction technologies. These financial and procedural hurdles disproportionately affect low-income groups, reinforcing social exclusion and undermining equitable access to sustainable housing. This interpretation supports the argument that for sustainability in housing to be meaningful and inclusive, policy and legislative frameworks must be not only technically sound but also socially responsive and economically accessible.

The prominence of theme 4, as revealed through the thematic analysis, affirms the centrality of policy and legislative coherence, institutional alignment, and accountable governance in advancing

sustainable housing development in Kenya. These insights reinforce the study's theoretical grounding in Ecological Modernization and Innovation Diffusion theories, which advocate for integrated, systemic transformations in governance and institutional arrangements to achieve sustainability goals.

5.2.4 Contribution of Existing Housing Approaches to Sustainability of Housing in Kenya

The third research objective sought to find out the extent to which existing housing approaches have contributed to sustainability of housing in Kenya. From statistical analysis of the questionnaire data, the existing housing approaches give a weighted mean score of 3.2444 indicating a moderately positive perception of current housing strategies, indicating that while some progress has been made, there remains room for improvement to fully align these approaches with sustainability of housing objectives. The housing approaches items with the highest mean score were private sector housing development and community-led initiatives (e.g. cooperatives and self-built housing). These two were contributing to sustainability of housing, followed by the self-built and incremental housing and are deemed as viable and affordable solutions to housing sustainability. The high mean scores reveal the potential of bottom-up approaches in advancing sustainability of housing. However, the lower scores for government-led and institutional initiatives reveal gaps in inclusivity, policy coordination, and systemic support.

The study deduces that for sustainability of housing to be realized, there must be a strategic shift towards integrated, participatory, and context-specific housing policies that bridge the gap between top-down institutional mechanisms and grassroots initiatives. Enhanced support for community-led models, coupled with reforms in public housing programs and financial systems, is essential for promoting long-term housing sustainability in Kenya.

The study's findings on existing housing approaches align with the World Bank (2020) report, which highlights the vital role of the private sector in complementing government efforts to meet Kenya's housing demand. The private sector significantly contributes to urban expansion, real estate development, and overall economic growth. Key actors including private developers, financial institutions, and investors are presented as instrumental in increasing housing availability, particularly for middle- and upper-income earners. Additionally, social and rental housing play a crucial role by offering affordable options for low- and middle-income populations.

The significance of self-built housing supports earlier findings by GoK (2018), which emphasized self-built and incremental housing as key strategies for addressing Kenya's housing needs. These approaches allow individuals and families to construct homes gradually, based on their financial capacity. By enabling affordable and flexible homebuilding, they reduce reliance on large-scale developers. Many households prioritize essential structures first, expanding their homes over time as resources allow.

The study results provide similar outcomes to those of Anderson and Mwelu (2013), who undertook studies on KENSUP and KISIP. These programs sought to improve living conditions in informal settlements through infrastructure development, housing improvements, and community engagement and achieving Sustainable Development Goal 11. The evaluation of KENSUP and KISIP highlighted the complexities involved in slum upgrading efforts. While the programs made strides in improving living conditions and involving communities, systemic challenges persisted. For sustainable urban development, it is imperative to address implementation bottlenecks, foster integrated policy frameworks, and ensure inclusive approaches that bridge urban and rural divides. The experiences from Huruma and Mathare informal settlements in Nairobi underscore the potential of community-led initiatives in driving meaningful change, emphasizing the need for policies that empower local stakeholders and promote holistic development strategies. These discussions show that the prevalent strategies to housing are in sync with the gentrification theory.

As an outcome of FGD data analysis, Theme 7: *Global Best Practices and Lessons Learnt* intersects meaningfully with Objective iv, which focused on evaluating the contribution of existing housing approaches to sustainable development in Kenya. This theme offers a comparative lens, allowing stakeholders to benchmark Kenya's current housing approaches against tested and proven strategies from other countries.

Global experiences in sustainable housing present innovative planning models, design standards, community-led approaches, and green technologies that have been successful in improving sustainability outcomes. These case studies act as learning tools, revealing not only what works, but also under what conditions certain housing approaches thrive. For instance, the adoption of modular construction, net-zero energy buildings, or inclusive urban planning models in countries such as Singapore, Japan, Belgium, provides practical insights that can guide the refinement of Kenya's own approaches. Through this theoretical lens, the study identifies where Kenya's housing

strategies align with or diverge from international norms. This comparison helps highlight strengths to build on—such as the government's focus on affordable housing—and gaps that need urgent redress, like weak integration of climate-responsive designs or the limited scale of community-based initiatives.

The FGD identified the current housing approaches, especially public housing programmes and slum upgrading schemes, as having struggled to meet sustainability objectives. While these initiatives often address the quantitative housing deficit, they fall short on qualitative dimensions such as economic inclusivity, environmental resilience, and community integration. The discussions identified a persistent challenge including: existing approaches tend to adopt a "build and deliver" model with limited attention to the socio-cultural and behavioral realities of target communities. For instance, cases were cited where recipients of upgraded housing rented them out, reflecting a disconnect between intervention goals and community needs and therefore raising the question on how sustainable are these developments?

Discussants also critiqued the poor integration of housing with supporting infrastructure such as transport, schools, green spaces, and public utilities. This "infrastructure mismatch" results in the rapid degradation of housing estates and erodes social cohesion. Buruburu Estate, in Nairobi was specifically mentioned as a cautionary example of urban decay due to inadequate planning. Nonetheless, emerging initiatives such as the Safari Green Building Index and institutional partnerships (e.g. Kenya Green Building Society, Architectural Association of Kenya) were acknowledged as progressive efforts toward contextualized sustainability of housing solutions. These accentuates the potential for scaling sustainability through localized innovation and stakeholder collaboration.

5.2.5 Contribution of Housing Design Innovations Approaches to Sustainability of Housing in Kenya

The last objective of the study sought to establish the extent to which the housing design innovations have contributed to sustainability of housing in Kenya. Statistical analysis of the questionnaire data reveals that innovative housing design elements are perceived as key drivers of sustainability of housing in Kenya. The strong mean scores suggest that stakeholders recognize the multi-dimensional value of environmental, economic, and social in integrating modern design principles and technologies into housing systems. The findings support the argument that Kenya's sustainability of housing

agenda must prioritize policy and practice integration of innovative design solutions. Specifically, policymakers should enhance incentives for passive designs, smart technologies, and water conservation systems. The result indicates that investments should be directed toward raising awareness and reducing costs associated with green building materials. The moderate rating for modern construction techniques points to the need for industry capacity-building and regulatory support to expand these methods.

These findings align with Mari et al. (2020), who confirmed the effectiveness of green passive techniques in low-income communities. Their study showed that strategies such as building orientation, shading, natural ventilation, daylighting, and the use of open spaces significantly reduced electricity usage, leading to lower housing costs for low-income households. The study's findings are consistent with those of Ali and Alzu'bi (2017), who examined affordable housing projects in Jordan to develop a sustainable model. Their research demonstrated that incorporating passive solar design strategies can significantly reduce annual energy consumption and drastically cut water usage. The study emphasized the importance of prioritizing environmental and sustainability considerations in housing initiatives.

Similar findings were reported by Romero et al. (2023), who evaluated modular construction methods using environmentally friendly building materials as part of sustainability of housing projects. The study found that modular housing, when integrated with solar panels, could effectively meet the Net Zero Homes (NZHs) target by significantly reducing energy consumption. The proposed approach was considered a promising alternative for the housing market due to its lower cost and shorter construction time compared to traditional methods. The researchers concluded that the use of the Skylark 250 model in modular housing presents a substantial opportunity to enhance efficiency and sustainability in the construction sector.

Related findings were presented by Bredenoord (2017), who argued that traditional building materials such as iron, cement, and concrete are environmentally harmful due to their high greenhouse gas emissions. In contrast, sustainable alternatives include bamboo, recycled steel, reclaimed wood, cork, and straw bales. Bamboo is renewable, strong, and flexible; recycled steel helps lower carbon emissions; reclaimed wood supports modern construction aesthetics; cork offers sound absorption and insulation; and straw bales provide excellent thermal insulation.

Bredenoord emphasized that integrating modern technologies with local building traditions is essential for promoting truly sustainable construction practices.

These findings align with Ecological Modernization Theory (EMT) and Innovation Diffusion Theory (IDT), which suggests that societies and industries can move toward development and sustainability by adopting innovative design technologies and practices. Eco-friendly design strategies, as part of this transition, help reduce environmental impact and conserve natural resources. For example, incorporating natural lighting and passive solar heating in building design can significantly lower the need for artificial lighting and energy consumption, contributing to more sustainable and efficient housing solutions.

Following the FDG data analysis, Themes 6, 7 and 8 addressed research objective 5 to a great extent. Them 8: *Urban Planning, Infrastructure, and Integrated Design* addressed objective (v), by emphasizing spatial planning, urban infrastructure, and integration of design principles as core contributors to housing sustainability. The FGD emphasized that poorly planned infrastructure, such as inadequate roads, sewerage systems, and public spaces, undermines the sustainability of even the most well-designed housing units. The case of Buru Estate in Nairobi was cited as an example of how lack of integrated planning leads to service deterioration, social fragmentation, and long-term unsustainability. Participants pointed to an "infrastructure mismatch" where housing units are developed without corresponding investment in supporting infrastructure systems, reducing the benefits of innovative design. They stressed the need for urban regeneration strategies that combine housing with transport, green spaces, and commercial zones, ensuring housing innovations contribute meaningfully to environmental performance and quality of life. Thus, Theme 8 reinforces that design innovations must be part of an integrated urban planning approach to achieve sustainable housing in Kenya.

The FDG unearthed innovative design approaches as a critical enabler of sustainability of housing, provided they are economically viable and socially inclusive. Discussants emphasized that sustainability in design must go beyond green aesthetics to embrace life cycle thinking, adaptability, and the integration of social functionality. Environmental design elements such as rainwater harvesting, passive cooling, solar energy systems, and waste management were cited as desirable features. However, their adoption remains limited due to cost implications and lack of technical expertise, particularly in the low-income housing segment.

The FGD results advocated for mainstreaming sustainability into construction, urban design and housing finance related education, thereby embedding eco-consciousness at the professional level. The role of data and digital technology, such as real-time monitoring systems, geospatial mapping, building information modelling and disaster risk management tools, was also seen as transformative in planning and maintaining sustainability of housing environments. Global case studies from Singapore, Japan, Belgium, and Rwanda provided further inspiration, showing how design innovation, when supported by effective policy and financing, can yield long-term affordability, livability, and resilience. Local innovations like Mwambalazi, a rural village in Kwale County were commended for promoting social cohesion and community-centered design, reinforcing the need for culturally responsive housing innovations.

5.2.6 Discussion of Dominant Themes in Housing in Kenya

From the thematic analysis of the Focus Group Discussion (FGD) data, eight key themes emerged as the most dominant across participants' responses, as follows: -

- Theme 1: conceptualizing sustainability of housing in Kenya.
- Theme 2: achievements and gaps in sustainability of housing in Kenya.
- Theme 3: enablers of sustainability of housing in Kenya.
- Theme 4: policy, institutional cohesion and governance for sustainability of housing in Kenya. Theme 5: innovative financing models for sustainability of housing in Kenya.
- Theme 6: role of data and technology in sustainability of housing in Kenya.
- Theme 7: global best practices and lessons learnt for sustainability of housing in Kenya,
- Theme 8: urban planning, infrastructure and integrated design for sustainability of housing in Kenya.

Lexical analysis and in particular word cloud revealed a thematic focus on conceptualization of housing sustainability (from an environmental, social and economic standpoint), with an emphasis on urban and housing development issues focusing on people.

The thematic analysis of the FGD data reveals a multidimensional understanding of the sustainability of housing in Kenya. The emergence of eight dominant themes underscores the complex interplay between conceptual, structural, financial, and technological aspects that

shape sustainable housing outcomes. In sync with the first research objective, the first theme highlights the foundational need to define and contextualize what sustainability means in the Kenyan housing sector, reflecting varying perceptions that align with environmental, social, and economic pillars. The second and third themes expose both progress and persistent gaps, as well as the enablers like policy initiatives, stakeholder collaboration, and capacity building that are critical for advancing sustainability goals.

The fourth theme points to the significance of coherent policies, institutional coordination, and governance structures in addressing fragmentation within the housing sector. This aligns with the study's second and third objectives of evaluating the influence of policy and legislative frameworks. The fifth theme on innovative financing models indicates a shift in thinking towards inclusive and adaptive funding mechanisms that respond to affordability challenges. This theme aligns with objective five that sought to examine how housing design innovations could contribute to sustainability of housing in Kenya. The sixth and seventh themes recognize the evolving roles of data-driven planning, technological innovation, and the importance of adapting global best practices to local contexts. Lastly, the eighth theme underscores the centrality of integrated urban planning, infrastructure development, and design thinking in achieving long-term sustainable housing outcomes.

The lexical analysis, particularly the word cloud, supplements the thematic emphasis on holistic conceptualizations of housing sustainability, with urban development and people-centered approaches taking precedence. These findings directly support the argument that sustainability in housing requires a systemic and integrated approach, anchored in innovative designs, responsive policies, and multi-stakeholder engagement to effectively address Kenya's current and future housing needs.

5.3 Conclusions

The thematic analysis of the Focus Group Discussion (FGD) data provides conclusive evidence that sustainable housing in Kenya is a multidimensional challenge that demands a comprehensive, systemic response. The eight dominant themes identified underscore the interdependence of factors in influencing sustainability in the housing sector. Critically, these themes align with and reinforce the five research objectives, affirming the relevance of examining policies, legislation, approaches, and innovations as key levers for sustainability. The findings demonstrate that while Kenya has

made notable strides, particularly through policy alignment with global sustainability agendas and initiation of programmes like the Affordable Housing, significant gaps remain in the implementation, institutional coordination, and integrated infrastructure planning. The persistence of fragmented governance, policy silos, and infrastructure mismatch weakens the potential impact of well-intentioned sustainable housing development efforts.

Furthermore, the lexical analysis of focus group data highlights the need for centrality of people-oriented, environmentally sound, and economically viable urban development strategies. This supports the dissertation argument that achieving sustainable housing in Kenya requires more than isolated interventions, it necessitates a transformative shift in planning, regulation, financing, and design that is inclusive, participatory, and context-responsive. When thinking sustainability in housing, the central concern should be on the people, their needs and dignity. This is underscored in the study's lexical analysis which showed; "Sustainability", "Housing", "Think", "People" as the most important words from the Focus Group Discussion.

The assessment of Kenya's housing sustainability based on the site visit data reveals notable strengths in environmental compliance and site planning, yet exposes critical deficiencies in economic viability, technological integration, and inclusive design. While regulatory frameworks have effectively driven environmental standards, the absence of innovative materials, smart technologies, and socially responsive design signals a need for broader, people-centered strategies. Uneven performance across sites highlights the influence of local capacities and institutional support. Advancing sustainability of housing in Kenya therefore necessitates a transition from compliance-driven approaches to holistic, context-sensitive models that balance environmental stewardship, economic feasibility, and social cohesion.

The study concluded that while Kenya's housing policies reflect commendable alignment with global and national sustainability agendas, their impact on sustainability of housing remains limited due to gaps in implementation, clarity, and contextual relevance. Policies such as the Affordable Housing Programme show strong intent but fall short in defining and operationalizing sustainability across environmental, economic, and social dimensions. Both qualitative and quantitative findings underscore the moderately perceived effectiveness of existing policies, hindered by inadequate public participation, weak maintenance frameworks, and insufficient support for innovation. Achieving sustainability of housing in Kenya thus demands a paradigm

shift toward outcome-based, localized, and participatory policy frameworks that integrate lifecycle thinking, inclusive planning, and adaptive governance.

The analysis of Kenya's housing legislation reveals a landscape marked by institutional milestones such as the 2024 Building Code and green certification frameworks, yet undermined by weak implementation, fragmented governance, and high compliance costs. While legislative instruments offer a foundation for sustainability, their limited coordination, lack of enforcement, and exclusionary impacts on low-income groups hinder meaningful progress. Quantitative findings reflect moderate effectiveness, with critical gaps in policy integration, affordability, and land use legislation. Advancing sustainability of housing thus requires streamlined legal reforms, centralized oversight, incentive-driven enforcement, and inclusive, accountable governance to fully align legislation with sustainability objectives.

The study finds that existing housing approaches in Kenya, particularly public housing programmes and slum upgrading initiatives, have had limited success in achieving holistic sustainability. While these strategies address quantitative deficits, they often overlook critical qualitative aspects such as socio-cultural alignment, environmental resilience, and infrastructure integration. A moderately positive perception of current approaches highlights the emerging potential of private sector efforts and community-led models like self-built housing. However, institutional approaches remain constrained by policy fragmentation and limited inclusivity. Advancing sustainability of housing in Kenya will require a paradigm shift toward integrated, participatory, and context-specific strategies that bridge top-down policies with grassroots innovation, lived experiences and empower communities through flexible, affordable, and locally adapted solutions.

The study deduced that housing design innovations are pivotal to advancing sustainability of housing in Kenya, particularly when they integrate environmental, economic, and social dimensions. Despite limited adoption, mainly due to cost and technical capacity constraints, design strategies such as passive cooling, solar energy, rainwater harvesting, and modular construction hold significant potential. The findings highlight the importance of embedding sustainability in construction related education, policy frameworks, and professional practice. Emphasizing culturally responsive and community-centered designs, the study calls for increased investment, incentives, and regulatory support to mainstream innovative, eco-efficient solutions. Aligning with

Ecological Modernization Theory and Innovation Diffusion Theory, the research underscores that sustainability of housing is attainable through the strategic adoption of green technologies and adaptive design approaches.

In conclusion, the study affirms that sustainability of housing is a complex, multifaceted construct influenced by policy, law, design, technology, and socio-economic factors. Advancing housing sustainability in Kenya requires integrated interventions, spanning environmental stewardship, economic viability, and social inclusivity, supported by policy innovation and context-sensitive design. The theoretical alignment observed affirms the utility of the applied framework and provides a foundational basis for future research, planning, and policy development aimed at fostering equitable and resilient urban housing systems for sustainable outcomes.

5.4 Recommendations

In this section, the study findings are leveraged to make policy recommendation, management recommendations and scholarly suggestions.

5.4.1 Policy Recommendations

The study recommends for a shift in housing policy and planning frameworks from a mostly compliance-oriented model to a holistic, people-centered approach that encompasses environmental, economic, and social aspects of sustainability for sustainability of housing in Kenya. Priority must be given to lifecycle costing, community inclusion, and equal access to amenities to foster enduring affordability and social cohesion. The study recommends for the modification of housing regulations to incorporate explicit, localized sustainability metrics that extend beyond affordability to encompass environmental, economic, and social aspects. Transition from an emphasis on housing quantity to prioritizing long-term sustainability outcomes like adequacy, accessibility, livability, resilience, maintenance and whole lifecycle performance of housing initiatives is recommended.

To improve the multidimensional sustainability of housing projects, it is recommended that the government should implement policy reforms that encourage the adoption of new technology, sustainable materials, and inclusive design approaches. This could encompass providing subsidies, tax incentives, other mechanisms for financial assistance as well as enhancing technical ability to promote the adoption of sustainable practices, particularly in housing developments targeting low-income earners.

The study advocates for the advancement of inclusive, data-informed policy formulation and the institutionalization of participatory planning through the engagement of communities and stakeholders in the policy-making process. Employing data-driven methodologies and ongoing performance evaluation to guarantee that policies are effective, adaptable, and consistent with housing sustainability objectives. The study recommends for the creation of a centralized regulatory entity to coordinate, monitor, and implement housing sustainability legislation across several industries. This study further advocates for the streamlining of compliance procedures and government support to the full realization of a Kenyan specific green rating tool to mainstream sustainability of housing in the country.

5.4.2 Management Recommendations

Managers engaged in housing should formulate context-specific sustainability plans and designs that cater to the unique social, economic, and environmental needs of different communities and locations especially in the identified underperforming aspects of sustainability highlighted in the study. Secondly, construction professionals, construction companies and developers must emphasize capacity building and training regarding sustainable practices including application of green rating tools, understanding provisions of the building code 2024, energy-efficient designing, safety standards, and the integration of smart technologies. Third, managers must implement a robust system for continuous monitoring and performance assessment of housing projects to ensure adherence to sustainable goals. This should include indicators pertaining to environmental performance, economic viability/affordability, and community welfare. Developers and other housing related institutions/authorities should deploy digital data driven initiatives in formulating housing programmes and should involve communities as well as sustain open communication during the housing development process to foster inclusivity and reduce opposition to urban transformation agenda.

5.5 Suggested Areas for Further Research

In the light of the foregoing, four areas for further research are suggested as follows: Firstly, the functionality and adoption of rating tools for assessment of building sustainability. It is necessary to establish which of the scientific tools – for example, BREEAM (Building Research

Establishment Environmental Assessment Method), LEED (Leadership in Energy and Environmental Design), and EDGE (Excellence in Design for Greater Efficiencies) – is most suited to housing sustainability assessments in Kenya. Secondly, further investigation is necessary to explore the nexus between sustainability programs and gentrification processes, particularly concerning the inadvertent repercussions of green development on social exclusion or relocation. Future study should include longitudinal studies to assess the enduring efficacy of sustainability initiatives in housing developments in Kenya and other sub-Saharan African countries. Future research should emphasize the creation of integrated governance models that transcend institutional silos to advance sustainable practices in housing. Thirdly, future research should explore novel economic tools and subsidy frameworks that mitigate financial obstacles, ensuring the sustainability of housing remains accessible and economically feasible throughout its life cycle.

Future research should undertake empirical studies to create digital tools and analytical frameworks that enhance governance and planning for sustainable housing. Analyzing the impact of real-time data on policy responsiveness and sustainability in the housing sector is crucial. Finally, there is the need to investigate capacities of the institutional framework in the housing sector for the delivery of the elusive sustainability dream. Whatever the number or quality of housing policies, legislations or approaches, sustainability of housing is rendered unachievable if the institutional players work suboptimal or at cross-purposes.

5.6 Limitations of the Study

Despite the study's comprehensive design and methodological triangulation, several limitations are acknowledged that may influence the interpretation, generalizability, and applicability of the findings. The study was geographically confined to the Kenyan housing sector, which, while offering a valuable national perspective, limits the ability to generalize findings to other countries or regional contexts with differing policy, legislative, and socio-economic environments. The research relied heavily on the willingness and availability of key stakeholders, including policymakers, private developers, and professional associations, to provide accurate and complete information. Although purposive sampling was used to target informed participants, there is a possibility of non-response bias or social desirability bias, particularly where respondents may have withheld negative assessments of policy effectiveness

or overemphasized their contributions to sustainable housing practices.

While the study applied both qualitative and quantitative techniques to enhance validity through triangulation, each method carries inherent limitations. quantitative data, such as survey responses, may not fully capture the complexity and nuance of stakeholder perceptions or institutional dynamics. Conversely, qualitative data from focus group discussions and site observations are context-rich but may be limited in breadth and susceptible to researcher interpretation bias. The study was conducted between November 2024 and April 2025, a relatively short period for assessing long-term sustainability outcomes. Given that Kenya's legislative and policy environment is undergoing significant transition, such as the replacement of the 1968 Building Code by the 2024 version, there is a risk that some findings may be rendered partially outdated or less applicable as newer policies and standards take effect post- study.

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APPENDICES

Appendix I: Ethical Approval

Strathmore UNIVERSITY

14th April 2025

Mr Njuguna David,
d.mathu@nhckenya.go.ke

Dear Mr Njuguna,

RE: Influence of Housing Policies, Legislations, Approaches and Designs on Sustainability of Housing in Kenya

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** proposal. Your application reference number is **SU-ISERC2824/25.** The approval period is from **14th April 2025 to 13th April 2026.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

Mr Ambrose Rachier,
Chairperson; SU-ISERC

Ole Sangale Rd, Madaraka Estate. PO Box 59857-00200, Nairobi, Kenya. Tel +254 (0)703 034000
Email admissions@strathmore.edu www.strathmore.edu

Appendix II: Research Permit By NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **204485**

Date of Issue: **14/April/2025**

RESEARCH LICENSE

This is to Certify that Mr.. David Mathu Njuguna of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Baringo, Bomet, Bungoma, Busia, Elgeyo-Marakwet, Embu, Garissa, Homabay, Isiolo, Kajiado, Kakamega, Kericho, Kiambu, Kilifi, Kirinyaga, Kisii, Kisumu, Kitui, Kwale, Laikipia, Lamu, Machakos, Makueni, Mandera, Marsabit, Meru, Migori, Mombasa, Muranga, Nairobi, Nakuru, Nandi, Narok, Nyamira, Nyandarua, Nyeri, Samburu, Siaya, Taita-Taveta, Tanariver, Tharaka-Nithi, Transnzoia, Turkana, Uasin-Gishu, Vihiga, Wajir, Westpokot on the topic: INFLUENCE OF HOUSING POLICIES, LEGISLATIONS, APPROACHES AND DESIGNS ON SUSTAINABILITY OF HOUSING IN KENYA for the period ending : 14/April/2026.

License No: **NACOSTI/P/25/417610**

204485

Applicant Identification Number

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Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to.
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. Neither the license nor any rights thereunder are transferable.
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and
Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke

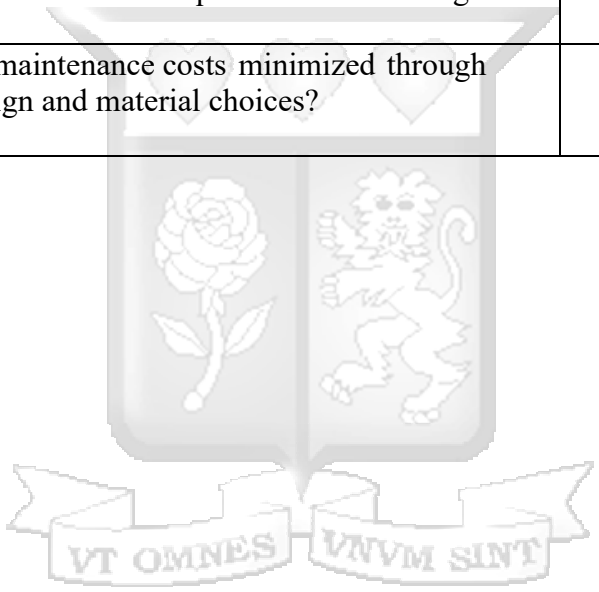
Appendix III: Observation Checklist for Housing Development Projects

Site visit and observation of key housing projects; appraising the level of sustainability in housing.

Please indicate – Yes (√) or No (x) in respect of the following aspects of housing sustainability in this project:

Sn	Item Observed	Yes (√)	No (X)
1	Is the site layout optimized for views?		
2	Is the site layout optimized for wind direction?		
3	Is the site layout optimized for sunlight?		
4	Are there clear markings for boundaries and designated areas for construction activities?		
5	Are there measures in place to minimize environmental impact (erosion control, drainage)?		
6	Are sustainable or recycled materials being used in construction?		
7	Is there evidence of local sourcing of materials to reduce transportation emissions?		
8	Are energy-efficient design principles (e.g., passive solar, natural ventilation) evident?		
9	Are renewable energy systems (e.g., solar panels, wind turbines) integrated into the design?		
10	Are smart home technologies being integrated (e.g., energy monitoring, smart thermostats)?		
11	Is there evidence of prefabrication techniques that enhance efficiency?		
12	Are innovative construction methods (e.g., modular construction, 3D printing, IoT) being utilized?		
13	Are there designated areas for waste segregation on-site?		
14	Are safety measures in place and followed by workers (e.g., PPE, safety barriers)?		
15	Is the site in compliance with local building codes and regulations?		
16	Are there inspections occurring regularly for adherence to safety and quality standards?		
17	Are there signs of community consultation or involvement in the project planning process?		
18	Are there adequate open spaces in the building landscape?		
19	Is there a balance between hard (concrete, stone, etc.) and soft (vegetation) landscaping?		
20	Do the items in the gardens/open spaces require minimal water, labour or maintenance?		

21.	Does the project promote community interaction through shared amenities and open spaces?		
22.	Are provisions made for inclusive access to housing for vulnerable and marginalized groups?		
23.	Has the community been actively engaged in the planning and decision-making process?		
24.	Does the project contribute to local economic development by creating jobs or supporting local businesses?		
25.	Has the project reduced housing costs through innovative construction techniques or local sourcing?		
26.	Are long-term maintenance costs minimized through sustainable design and material choices?		



Appendix IV: Questionnaire for Key Players in the Housing Sector

Dear Participant,

This questionnaire is designed to collect information regarding the influence of housing policies, legislations, approaches, and designs on sustainability of housing in Kenya. Your responses will be kept confidential and used solely for academic purposes.

Part A: Background Information

1. How long have you been involved in housing-related matters in Kenya?

   Less than 5 Years [ ]
   6 to 10 Years [ ]
   11 to 15 Years [ ]
   More than 16 Years [ ]

2. In which area of housing are you involved?

   Policymaker [ ]
   Developer [ ]
   Professional [ ]
   Financial institution [ ]
   Contractor [ ]
   Other, specify _____

3. How would you rate your knowledge of sustainability of housing practices?

   Very low [ ]
   Low [ ]
   Moderate [ ]
   High [ ]
   Very high [ ]

Part B: Existing Housing Policies and Sustainability of Housing

Please indicate (√) the extent to which you agree with the following statements on existing housing policies and sustainability of housing in Kenya, using the scale below:

1 = Strongly Disagree, 2 = Disagree, 3 = Moderately Agree, 4 = Agree, 5 = Strongly Agree.

	Statement	1	2	3	4	5
1.	National housing policies have significantly enhanced the development of sustainability of housing.					
2.	The Affordable Housing Programme (AHP) has significantly improved sustainability of housing development.					
3.	The National Urban Development Policy (NUDP) has effectively led to sustainable urbanization.					
4.	Government policies have effectively promoted Public-Private Partnerships.					
5.	Building maintenance policies have significantly enhanced the development of sustainability of housing.					
6.	Public participation is adequately incorporated in the development of housing policies and programs.					
7.	Government policies are adequate for sustainability of housing development.					

Part C: Existing Legislations and Sustainability of Housing

Please indicate (√) the extent to which you agree with the following statements on existing housing legislations and sustainability of housing in Kenya, using the scale below:

1 = Strongly Disagree, 2 = Disagree, 3 = Moderately Agree, 4 = Agree, 5 = Strongly Agree.

	Statement	1	2	3	4	5
1.	Legislations governing land use (e.g. Land Act, Urban Areas and Cities Act) are contributing for sustainability of housing.					
2.	Legislations related to housing development (e.g. Housing Act Cap. 117, NCA Act of 2011 and Affordable Housing Act of 2024) are contributing to sustainability of housing.					
3.	The Public-Private Partnership Act contributes positively to sustainability of housing initiatives.					
4.	There are adequate institutions to drive sustainability of housing.					
5.	Building codes enforce sustainability standards in housing.					
6.	There are adequate capacities (e.g. managerial, material, technical and skills) to drive sustainability of housing.					
7.	Existing framework of laws, regulations and institutions is adequate for sustainability of housing development.					

Part D: Existing Housing Approaches and Sustainability of Housing

Please indicate (√) the extent to which you agree with the following statements on existing housing approaches and sustainability of housing in Kenya, using the scale below:

1 = Strongly Disagree, 2 = Disagree, 3 = Moderately Agree, 4 = Agree, 5 = Strongly Agree.

	Statement	1	2	3	4	5
1.	Public housing developments by national government agencies (e.g. the outright sale, rental and tenants purchases schemes by NHC and NSSF) and county governments have contributed to sustainability of housing.					
2.	The Kenya Slum Upgrading Programme (KENSUP) has improved urban living standards and contributed to sustainability of housing.					
3.	Employer-assisted housing schemes, such as the Civil Servants Housing Scheme Fund, have enhanced sustainability of housing.					
4.	Private sector housing development and community-led initiatives (e.g. cooperatives and self-built housing) are contributing to sustainability of housing.					
5.	Financial systems and institutional housing approaches (e.g. KMRC, employer-assisted schemes) have incentives for sustainability of housing development.					
6.	The self-built and incremental housing are viable and affordable solutions to housing sustainability.					
7	Generally, existing housing approaches are adequate for promoting sustainability of housing.					

Part E: Adoption of Innovative Housing Designs and Sustainability of Housing

Please indicate (√) the extent to which you agree with the following statements on innovative housing designs for sustainability of housing in Kenya, using the scale below:

1 = Strongly Disagree, 2 = Disagree, 3 = Moderately Agree, 4 = Agree, 5 = Strongly Agree.

	Statement	1	2	3	4	5
1.	Passive design strategies (e.g. natural ventilation and solar energy utilization) enhances sustainability of housing.					
2.	Use of green building materials (e.g. bamboo and green cement) enhances sustainability of housing.					
3.	Water conservation systems (e.g. rainwater harvesting, waste water recycling) improve housing sustainability.					
4.	Green infrastructure (e.g. green roofs, urban parks) enhances community social well-being and sustainability of housing.					
5.	Smart home technologies (e.g. Internet of Things - IoT i.e. enabled monitoring and BIM) improves energy efficiency, security, convenience, maintenance and overall sustainability of housing.					
6.	Adoption of modern construction techniques (e.g. modular housing, Light Gauge Framing Systems (LGFS) and prefabrication) enhances sustainability of housing.					
7	Generally, housing designs (e.g. sizes, configurations, typologies and materials) are determinants of sustainability of housing.					

Thank you for your time and valuable input.

Appendix V: Focus Group Discussion Guide - Managers, Professionals & Scholars in the Housing Sector

This Focus Group Discussion aims to address the subject of sustainability of housing in Kenya, and factors that impact on it, for the purpose of enhancing achievement of the phenomenon in the country. Your responses will be kept confidential and used solely for academic purposes.
The discussion will take not more than 2 hours.

---

1. To what extent has Kenya so far achieved sustainability in housing?

2. What factors enhance the country's achievement of sustainability in housing?

3. What factors inhibit the country's achievement of sustainability in housing?

4. In what ways has the housing sustainability achieved in Kenya so far affected housing affordability and/or economic opportunities for the residents?

5. How has the housing sustainability achieved in Kenya so far, affected quality of the residents' lives and/or social cohesion amongst communities in the country?

6. What are the cases of global best practices, which Kenya may emulate in her endeavor towards sustainability in housing?

7. In your opinion, what strategies can the country take to enhance the sustainability of housing at the grassroots and national levels of the country?

Appendix VI: Focus Group Discussion Forum Attendees

INFLUENCE OF HOUSING POLICIES, LEGISLATIONS, APPROACHES AND DESIGNS ON SUSTAINABILITY OF HOUSING IN KENYA: FOCUS GROUP DISCUSSION ATTENDANCE LIST.

08/04/2025

No.	NAME	PROFESSION	CONTACT/EMAIL	SIGNATURE
1.	Prof. Titus Kivaa	QS/CM.	tkivaa@kuat.ac.ke	
2	Dr. Eng. Murigi P	Civil Eng/Lec	murigijr@gmail.com	
3.	KEN LUUSA	CHARTERED SURVEYOR	KPluusa@kcbgroup.com	
4.	JOHN KABUYE	GREEN BUILDING	john.kabuye@absl-africa.com	
5.	RITA GICHERU	GREEN BUILDINGS	ritagicheru2010@gmail.com	
6	ARCH. PROF. ALFRED OMENYA	ENVIRONMENTAL ARCHITECT + HOUSING SPECIALIST	omenyaalfred@gmail.com aomenyazour@yahoo.co.uk	
7.	[illegible]	CAS	robertmwenge@gmail.com	
8.	CYNTHIA KINANI	ARCHITECT, EDGE Expert	cynthia.n.kinani@gmail.com	
9.	FLORENCE NYOLE	ARCHITECT & ENV. DESIGNER	florencenyole@gmail.com	
10.	ENG. MAURICE AKECH	CIVIL ENGR.	M.akechengaya@	
11.	Robert Gichohi	Project Manager	robert.gichohi@turntown.com	
12	Robert Rukwaro	Architect	rrukwaro@yahoo.com	
13	TED OTIENO	SUSTAINABILITY CONSULTANT	Ted@endustrialsupport.com	
14	Nashon Otieno	Project Manager	nashon.otieno@gmail.com	
15	Peter N. Biwott	Economist Development	peterbiwott2009@gmail.com	
16	Joshua O. Nyamwi	Lawyer	joshua.nyamwi@advocate@gmail.com	
17	AIDAH MUHANO	ARCHITECT	muhano.aidah@ku.ac.ke	
18	Dr Apopa Victoria	SC	V.apopa@uonbi.ac.ke	

INFLUENCE OF HOUSING POLICIES, LEGISLATIONS, APPROACHES AND DESIGNS ON SUSTAINABILITY OF HOUSING IN KENYA: FOCUS GROUP DISCUSSION ATTENDANCE LIST.

08/04/2025

No.	NAME	PROFESSION	CONTACT/EMAIL	SIGNATURE
19.	Beatrice Maina	Data analytics Finance & Lecturer	mainabeatrice305@gmail.com	[signature]
20	Watola Cynthia	Architect & Sustainability C	watola.c@gmail.com	[signature]
21	V. GIKONYO GITONGA	REAL ESTATE [illegible]	VGGITONGA @GMAIL.COM	[signature]
22	MAIRURA OMWENGA	Engineer/Town Planner	mairurao@yahoo.com	[signature]
23	MUTINDA MUTUKU, LPS	ICPSK/NCA	mutinda@buildnet	[signature]
24.	CHRISTINE MUCHIRI	AAK/TUK/MAGA PLAN	chrissie.n.muchiri@gmail.com	[signature]
25	Dr Hosea KILI	FCS, FKISM, LLB ICIFA	hkili@cpf.or.ke	[signature]
26	Philip Bett	NHC	philipbett@hotmail.com	[signature]
27	QS. Dennis Mathu	Principal Investigator/ Researcher	dmathue nhckenya.go.ke	[signature]

Appendix VII: Site Visit and Observation Feedback

Influence of Housing Policies, Legislations, Approaches and Design on Sustainability of Housing in Kenya: Observation Checklist for Housing Development Projects.

Please indicate – Yes (√) or No (x) in respect of the following aspects of housing sustainability in this project:

ITEM	QUESTION	1.Embu AHP		2.Kiri AHP		3.Park Road		4.Mavoko		5.Shauri		6.South B		7. South C		8.Soweto		9.Woodley		10.Ruiru	
		Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)	Yes (√)	No (X)
1	Is the site layout optimized for views?	YES		YES		YES		YES			NO	YES		YES		YES		YES		YES	
2	Is the site layout optimized for wind direction?	YES			NO		NO	YES			NO	YES			NO		NO	YES		YES	
3	Is the site layout optimized for sunlight?	YES			NO		NO		NO		NO	YES		YES			NO		NO		NO
4	Are there clear markings for boundaries and designated areas for construction activities?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
5	Are there measures in place to minimize environmental impact (erosion control, drainage)?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
6	Are sustainable or recycled materials being used in construction?	YES			NO		NO		NO	YES			NO		NO		NO		NO		NO
7	Is there evidence of local sourcing of materials to reduce transportation emissions?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
8	Are energy-efficient design principles (e.g., passive solar, natural ventilation) evident?	YES		YES			NO	YES		YES		YES		YES			NO	YES			NO
9	Are renewable energy systems (e.g., solar panels, wind turbines) integrated into the design?	YES		YES			NO	YES		YES		YES		YES		YES		YES		YES	
10	Are smart home technologies being integrated (e.g., energy monitoring, smart thermostats)?		NO		NO		NO		NO		NO		NO		NO		NO		NO		NO
11	Is there evidence of prefabrication techniques that enhance efficiency?		NO	YES		YES			NO	YES			NO		NO		NO		NO		NO
12	Are innovative construction methods (e.g., modular construction, 3D printing, IoT) being utilized?		NO		NO		NO	YES		YES			NO		NO		NO		NO		NO
13	Are there designated areas for waste segregation on-site?	YES		YES			NO		NO	YES		YES		YES			NO	YES			NO

14	A re safety measures in place and followed by workers (e.g., PPE, safety barriers)?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
15	Is the site in compliance with local building codes and regulations?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
16	A re there inspections occurring regularly for adherence to safety and quality standards?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
17	A re there adequate open spaces in the buildings' landscape?	YES		YES			NO	YES			NO	YES		YES			NO		NO		NO
18	Is there a balance between hard (concrete, stone, etc) and soft (vegetation) landscaping ?	YES			NO		NO		NO		NO		NO		NO		NO		NO		NO
19	Do the items in the gardens/open spaces require minimal water, labour or maintenance?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
20	Does the project promote community interaction through shared amenities and open spaces?	YES		YES		YES		YES		YES		YES		YES			NO	YES			NO
21	A re there provisions made for inclusive access to housing for the vulnerable and marginalized groups?		NO		NO	YES		YES		YES		YES		YES			NO		NO		NO
22	Has the community been actively engaged – i.e. consulted, petitioned, acknowledged, etc. - in the planning, decision-making and/or development process?	YES		YES		YES		YES		YES		YES		YES		YES			NO		NO
23	Does the project contribute to local economic development by creating jobs or supporting local businesses?	YES		YES		YES		YES		YES		YES		YES		YES		YES		YES	
24	Has the project reduced housing costs through innovative construction techniques or local material sourcing ?	YES		YES		YES		YES		YES		YES		YES		YES			NO	YES	
25	A re long-term maintenance costs minimized through innovative design and green material choices?	YES		YES			NO	YES		YES			NO		NO		NO		NO		NO

Appendix VIII: Sample Sites Visited

Influence of Housing Policies, Legislations, Approaches and Design on Sustainability of Housing in Kenya: Observation Checklist for Housing Development Projects.

Plate 01: Court Yard at Affordable Housing Scheme South B – Enterprise Road A

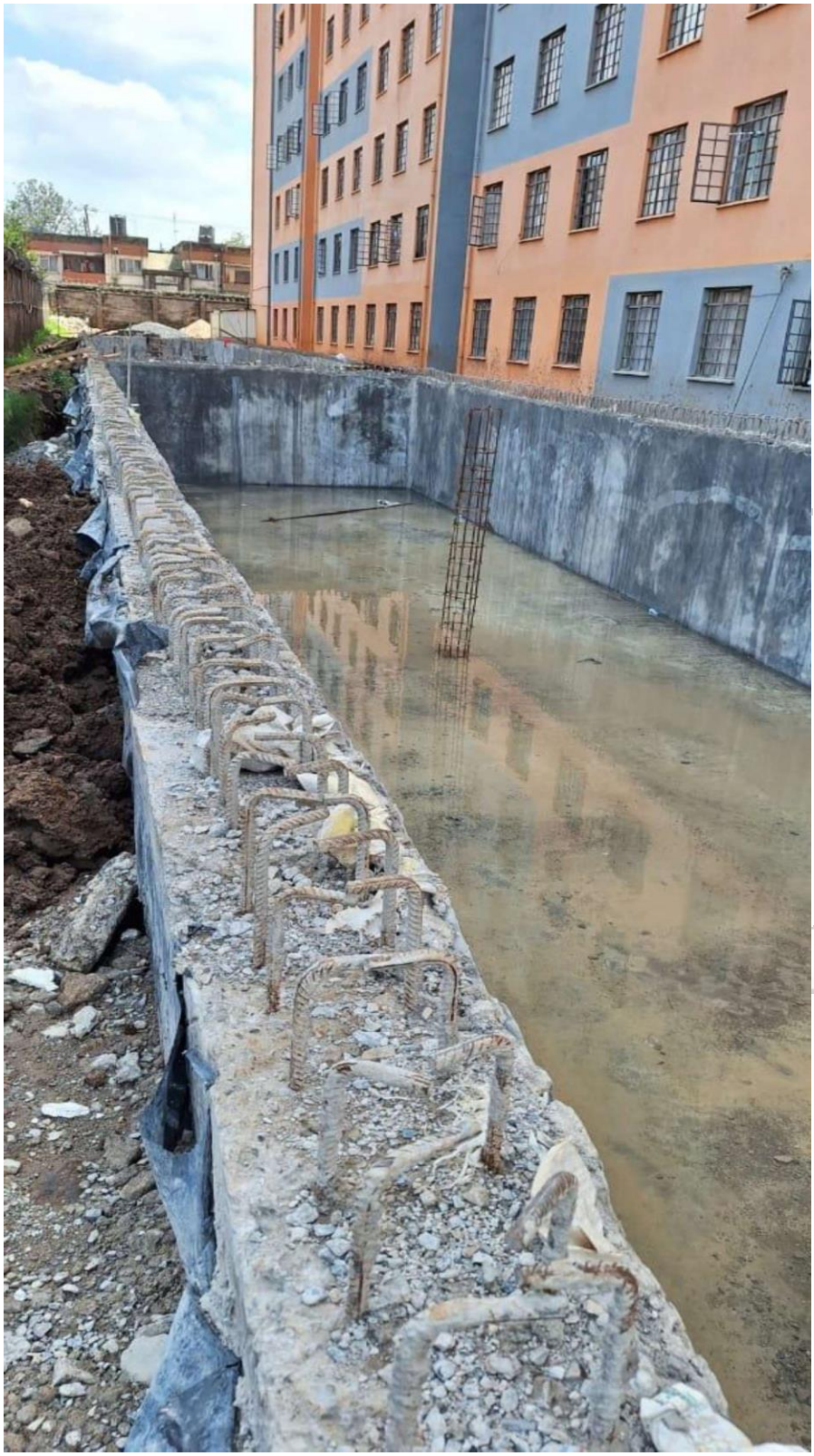


Plate 02: Construction of Additional 1Million Litres Underground Water Tanks at Park Road Affordable Housing Scheme

Appendix IX: Participant Information Sheet and Informed Consent

PARTICIPANT INFORMATION SHEET AND CONSENT FORM

Study Title: Influence of Housing Policies, Legislations, Approaches and Designs on Sustainability of Housing in Kenya

SECTION 1: The Researcher

Investigator: David Mathu Njuguna

Institutional Affiliation: Strathmore Business School (SBS)

SECTION 2: The Study

2.1: Why is this study being carried out?

This study seeks to explore how various housing approaches, policies, and design strategies impact the sustainability of housing in Kenya. The findings will contribute to a better understanding of effective practices and inform future housing developments.

2.2 Do I have to take part?

Participation is entirely voluntary. You may choose not to participate or withdraw from the study at any time without any penalty or loss of benefits to which you are otherwise entitled.

2.3 Who is eligible to take part in this study?

Individuals aged 18 and above who are involved in housing development, policy-making, architecture, or residents with experience in sustainability of housing practices in Kenya are eligible to participate.

2.4 Who is not eligible to take part in this study?

Individuals under the age of 18 or those without any direct or indirect experience related to housing in Kenya are not eligible to participate.

2.5 What will taking part in this study involve?

If you agree to participate, you will be asked to participate in an:

a) Interviews: Participate in a one-on-one interview lasting approximately (30 minutes),

where you will be asked about your experiences and opinions related to housing policies and design strategies.

b) Surveys/Questionnaires: Complete a survey that will take about (15 minutes) to gather quantitative data on housing sustainability factors.

2.6 Are there any risks or dangers in taking part in this study?

There are minimal risks associated with this study. However, discussing housing issues may evoke personal reflections. You may decline to answer any question or discontinue participation at any time.

2.7 Are there any benefits of taking part in this study?

While there may be no direct benefits to you, your participation will contribute to a deeper understanding of sustainability of housing practices in Kenya, potentially informing future policies and designs.

2.8 What will happen to me if I refuse to take part in this study?

Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. You may also withdraw from the study at any point without any consequences.

2.9 Who will have access to my information during this research?

All information collected will be kept confidential. Data will be anonymized, and any identifying details will be removed. Only the research team will have access to the data, and the results will be used for academic purposes, including publications and presentations, but individual participants will not be identifiable.

2.10 Data Management

The study shall adopt the data management protocol described below in order to uphold the highest standards of data integrity, security, and ethical compliance, thereby contributing valuable insights into sustainability of housing practices in Kenya.

1. Data Collection Protocols

The study shall collect both qualitative data (by interviews and observation) and quantitative data (by surveys and policy analysis). The qualitative data shall be gathered using an interview guide from stakeholders such as policymakers, architects, and construction firms amongst others. Quantitative data shall be collected using structured surveys to gather measurable data on housing policies and design strategies. This approach will be preferred because it allows for standardization of data collection instruments resulting in consistency and reliability across all

data sources.

2. Data Entry and Recording

Permission will be sought from the participants to allow for digital recording of interviews to ensure high-quality audio for accurate transcription. Efforts shall be made to ensure that data is transcribed verbatim to maintain the authenticity of responses. Data entry shall then be done through input of quantitative data into secure, password-protected databases, employing double-entry verification to minimize errors. The study shall implement clear and consistent file naming protocols to facilitate easy identification and retrieval of data files.

3. Data Storage and Security

The data shall be stored in encrypted institutional servers with regular backups to prevent data loss. The study shall employ user-specific login credentials with restricted data access to authorized research team members only. In guarding the physical security of the data, the study shall secure physical copies of data (e.g. consent forms) in locked cabinets within restricted-access areas.

4. Data Handling and Processing

To assure of respondent anonymity, the study shall remove or code personally identifiable information (PII) to protect participant identities, in compliance with Kenya's Data Protection Act, 2019. Data cleaning shall then follow to check the datasets for inconsistencies or errors, and documentation shall be done of any corrections made. The data shall be analyzed using NVivo 10 for Windows and SPSS version 25 to ensure compatibility with data formats and adherence to analytical standards.

5. Confidentiality and Privacy

Informed consent shall be obtained from all participants, detailing how their data will be used, stored, and shared. The researcher shall only share de-identified datasets only, to ensure that shared data cannot be traced back to individual participants. To meet legal compliance, the study shall be conducted in strict adherence to applicable data protection laws and regulations, including Kenya's Data Protection Act, 2019.

6. Documentation and Transparency

The study shall create a comprehensive metadata for each dataset, detailing data collection methods, processing steps, and any transformations applied. In regard to version control, the researcher shall maintain detailed records of data versions, including dates and descriptions of

changes, to ensure transparency in data handling. The study shall follow a Data Management Plan (DMP), by developing and regularly updating the DMP outlining procedures for data collection, storage, processing, and sharing.

2.11 Research Result Dissemination

Effective dissemination of research findings is crucial to ensure that the insights from this study on the Impact of Housing Approaches, Policies, and Design Strategies on Sustainability of housing in Kenya, reach relevant stakeholders and inform policy and practice. The following outline gives a comprehensive approach to disseminate the research results:

1. **Confidentiality of Results**

   Your individual data will remain confidential, and results will be reported in a way that protects your identity. There will be no disclosure of any personal information associated with your participation.

2. **Summary of Findings**

   After the study has concluded and data analyzed, a summary of the findings shall be shared with all participants. This summary will be written in clear, accessible language to ensure you understand the results and their implications.

3. **Academic Publications**

   The study shall submit articles detailing the study's methodology, findings, and implications to peer-reviewed journals focusing on housing policy, sustainable development, and urban planning. This will contribute to the academic discourse and ensure the research is accessible to scholars and practitioners.

4. Conferences and Workshops

The results of the study shall be presented at national and international conferences related to housing, sustainability, and policy development. This will facilitate knowledge exchange and networking with other researchers and professionals in the field.

Workshops shall be organized with stakeholders, including policymakers, urban planners, architects, and community leaders, to discuss the research outcomes and explore practical applications.

5. Policy Briefs

Resulting from the study, policy briefs shall be prepared in the form of executive summaries. The researcher shall develop concise policy briefs that highlight key findings

and recommendations, tailored for policymakers and government agencies. These shall be written in clear, non-technical language to facilitate understanding and action.

5. Community Engagement

Efforts shall be made to host community meetings to present findings to residents and local stakeholders, to ensure that the research addresses community needs and perspectives. Following these open forums, the study shall establish channels for community members to provide feedback, fostering a two-way dialogue that can enhance the relevance and impact of the research.

6. Media Outreach

If resources allow, the study results shall be distributed through press releases to local and national media outlets to announce significant findings and their implications for sustainability of housing in Kenya. During the press release the researcher shall make a media appearance and engage with journalists for interviews on television, radio, and podcasts to discuss the study's outcomes and their relevance to current housing challenges.

7. Institutional Repositories

The final research reports shall be deposited with the Strathmore University Library to for open-access institutional repositories to ensure long-term accessibility and visibility.

9. Capacity Building

Training Sessions shall be organized to offer training for local government officials, planners, and developers on implementing sustainability of housing strategies informed by the research findings.

10. Access to Results:

The respondent has opportunity to request a copy of any published materials resulting from this study. Please provide your contact information on the consent form if you wish to

receive these updates.

2.12: Who can I contact in case I have further questions?

You can contact me, David Mathu Njuguna at Strathmore Business School, by e-mail (mathunjugunas@yahoo.com), or by phone (0723558432). You can also contact my supervisor, Dr. Bernedette Wanjala, at the Strathmore Business School, Nairobi.

If you want to ask someone independent anything about this research, please contact:

The Secretary–Strathmore University Institutional Ethics Review Board, P. O. BOX 59857, 00200, Nairobi, email ethicsreview@strathmore.edu Tel number: +254 703 034418.

I, _____, have had the study explained to me. I have understood all that I have read and have had explained to me and had my questions answered satisfactorily. I understand that I can change my mind at any stage.

Please tick the boxes that apply to you;

Participation in the research study

☐ I AGREE to take part in this research

☐ DON'T AGREE to take part in this research

Storage of information on the completed questionnaire

☐ I AGREE to have my completed questionnaire stored for future data analysis

☐ DON'T AGREE to have my completed questionnaire stored for future data analysis

Participant's Signature:

_____ **Date**_____/_____/_____/

DD / MM / YEAR

Participant's Name:

Time _____/_____/_____/

HR / MN

_____

(Please Print Name)

I, _____ (Name of person taking consent) certify that I have followed the SOP for this study and have explained the study information to the study participant named above, and that s/he has understood the nature and the purpose of the study and consents to the participation in the study. S/he has been given opportunity to ask questions which have been answered satisfactorily.

Investigator's Signature:

_____ **Date_____/_____/_____/**

DD / MM / YEAR

Investigator's Name:

Time _____/_____/_____/

_____ **HR / MN**

(Please Print Name)

Appendix X: Study Protocol

STUDY PROTOCOL FOR THE STUDY ENTITLED: Influence of Housing Policies, Legislations, Approaches and Designs on Sustainability of Housing in Kenya

1. Introduction

Kenya faces a significant housing deficit, with approximately 93.6% of households living in inadequate housing, particularly in urban areas. This shortfall underscores the need for sustainability of housing solutions that align with environmental conservation and socio-economic development goals. Understanding the impact of various housing approaches, policies, and design strategies is crucial for informing sustainability of housing initiatives in Kenya.

2. Research Objectives

The general objective of this study will be to appraise the existing housing approaches, policies and legislations, innovative housing approaches and examine the extent to which they impact sustainability of housing in Kenya. The specific research objectives are:

i. To determine the extent to which the existing housing policies and legislations have contributed to sustainability of housing in Kenya.
ii. To examine the extent to which existing housing approaches have contributed to sustainability of housing in Kenya.
iii. To establish the extent to which the innovative design strategies have contributed to sustainability of housing in Kenya.

3. Study Design

The study will employ a mixed-methods approach to comprehensively analyze the qualitative and quantitative aspects of sustainability of housing. The study shall therefore adopt an exploratory research design and a descriptive research design. The study shall the triangulate the findings to enhance the credibility and validity of research findings by cross-verifying data from various sources.

4. Data Collection Methods

In order to inform the study results the study shall employ three data collection methods; online administration of questionnaire, key informant interviews, site visits of housing development sites in Kenya. Secondary data on existing housing practices, policies and legislation shall be collected using desktop survey methodology.

Online administration of the questionnaire shall entail the use of SurveyMonkey technique. SurveyMonkey will enable the researchers to create customized surveys tailored to the study's objectives. By designing questions that assess various housing approaches, policies, and design strategies, the researchers shall gather data directly from stakeholders such as residents, policymakers, and housing developers using the questionnaire in Appendix IV. The study shall use the interview guide in Appendix V to gather in-depth interviews from head of each of the organizations in Table 3.1. Site visits to Kenya's public housing projects will be conducted and the tool in Appendix VII applied. These visits will allow researchers to make empirical observations of the project's operation and design methods.

5. Data Collection Instruments

A standardized questionnaire shall be applied in collection of quantitative data (Appendix IV) and an interview schedule will be administered on housing experts (Appendix V) to gain insights on sustainability of housing in Kenya. A site visit Schedule (Appendix VII) shall be used in observing the construction sites.

6. Sampling Strategy

The study shall employ purposive sampling to reach few experts from select organizations involved in decision making, policy and practice of housing development in Kenya. The study shall adopt a key informant survey in comprising the sample of interest. More specifically, the study shall target the senior most executive, the technical lead and the chief finance officer of each organization as presented in Table 3.1. Because of the infinite population size, the study shall apply the Cochran's formula to arrive at the final sample size of 385 respondents.

7. Data Management and Analysis

NVivo 10 for Windows will be used for thematic content analysis, and qualitative analysis will be

focused on offering methodical and trustworthy data gathering and analysis. Transcript classification, coding, identifying recurring patterns, and recoding categories will all be possible with this software.

The study will utilize Statistical Packages for Social Scientists (SPSS Version 26) for quantitative analysis, and both descriptive and inferential statistics will be applied to the quantitative data. After that, the study will triangulate the various data sources to improve validity and reliability.

8. Ethical Considerations

Ethical issues will be carefully considered before data collection begins. Ethical clearance will be sought from Strathmore University's Internal Review Board to ensure compliance with research ethics. Additionally, permission to collect data from the public will be obtained from the National Commission for Science, Technology and Innovation (NACOSTI). A cover letter (Appendix I) will introduce the researcher, outlining the study's objectives and assuring respondents that the information gathered will be used exclusively for research purposes. Confidentiality and anonymity will be strictly maintained, and respondents' answers will be handled with the highest level of discretion. Prior to the commencement of data collection, all respondents will be required to provide written informed consent (Appendix VIII), ensuring voluntary participation. The interview guides will be coded to protect respondents' identities and maintain anonymity. Throughout the research process including data collection, analysis, and reporting, the researcher will uphold integrity by ensuring that no data is falsified, misrepresented, or manipulated as explained under the Data Management in section 2.10 of the Appendix VIII.

9. Expected Outcomes

The study is expected to assess the effectiveness of existing housing policies in promoting sustainability. This includes analyzing how well these policies address environmental conservation, energy efficiency, and social equity. These recommendations may include policy adjustments, incentives for green building practices, and guidelines for integrating sustainability into housing design and construction. The research is anticipated to analyze the environmental benefits of sustainability of housing approaches, such as reduced greenhouse gas emissions and improved resource efficiency. Additionally, the study will explore social impacts, including

enhanced living conditions and community well-being, resulting from the adoption of green housing practices. By focusing on sustainability of housing, the study aims to contribute to broader sustainable development goals, such as environmental protection, social equity, and economic growth. The insights gained can assist Kenya in aligning its housing sector with global sustainability targets.

10. Data Storage and Security

Data storage and security are crucial for a project's success. Data shall be backed up consistently, especially after any modifications or upon completion of data collection phases., The 3-2-1 rule shall be applied in storage, where: the original and two backups shall be kept. The original shall be stored in the researcher's local hard drive and copies located off-site or in cloud storage). To assure of proper documentation, a detailed record of data locations and backup schedules shall be kept facilitating data retrieval and ensure consistency. Consistent file names and a logical directory structure are essential for organization. A descriptive and consistent file names shall be developed that may include elements like research name, data type, date, and version number. The files shall then be organized in a logical directory structure that reflects the project's components, such as data collection methods, analysis, and reports. The study shall generate comprehensive metadata to describe data characteristics, including title, date of collection, methodology, variables, and file formats. This documentation shall facilitate understanding and reuse of the data.

11. Limitations and Mitigation Measures

The study may face the challenge of accessing reliable data due to poor record-keeping or proprietary restrictions can impede comprehensive analysis. To mitigate this this study shall establish a close working partnership with governmental agencies, non-governmental organizations, and private developers to access relevant data. The study shall also utilize data triangulation methods to validate information from multiple. The use of quantitative data is likely to have setbacks, such as not allowing the respondent to substantiate their response and the possibility of response bias if survey respondents misinterpret the questions. The study will leverage the use of qualitative approaches in data collection to lessen these restrictions.

Some players in the construction industry may not feel free divulge information. To overcome this,

the researcher will be introduced using the letter of authority from the University and a permit from NACOSTI. Further the respondents will be requested to sigh the informant consent form to give them the assurance that the information they give shall be treated with confidentiality.

12. Data Management

The study shall adopt the data management protocol described below to uphold the highest standards of data integrity, security, and ethical compliance, thereby contributing valuable insights into sustainability of housing practices in Kenya.

Data Collection Protocols

The study shall collect both qualitative data (by interviews and observation) and quantitative data (by surveys and policy analysis). The qualitative data shall be gathered using an interview guide from stakeholders such as policymakers, architects, and construction firms amongst others. Quantitative data shall be collected using structured surveys to gather measurable data on housing policies and design strategies. This approach will be preferred because it allows for standardization of data collection instruments resulting in consistency and reliability across all data sources.

Data Entry and Recording

Permission will be sought from the participants to allow for digital recording of interviews to ensure high-quality audio for accurate transcription. Efforts shall be made to ensure that data is transcribed verbatim to maintain the authenticity of responses. Data entry shall then be done through input of quantitative data into secure, password-protected databases, employing double-entry verification to minimize errors. The study shall implement clear and consistent file naming protocols to facilitate easy identification and retrieval of data files.

Data Storage and Security

The data shall be stored in encrypted institutional servers with regular backups to prevent data loss. The study shall employ user-specific login credentials with restricted data access to authorized research team members only. In guarding the physical security of the data, the study shall secure physical copies of data (e.g. consent forms) in locked cabinets within restricted-access areas.

Data Handling and Processing

To assure of respondent anonymity, the study shall remove or code personally identifiable information (PII) to protect participant identities, in compliance with Kenya's Data Protection Act, 2019. Data cleaning shall then follow to check the datasets for inconsistencies or errors, and documentation shall be done of any corrections made. The data shall be analyzed using NVivo 10 for Windows and SPSS version 25 to ensure compatibility with data formats and adherence to analytical standards.

Confidentiality and Privacy

Informed consent shall be obtained from all participants, detailing how their data will be used, stored, and shared. The researcher shall only share de-identified datasets only, to ensure that shared data cannot be traced back to individual participants. To meet legal compliance, the study shall be conducted in strict adherence to applicable data protection laws and regulations, including Kenya's Data Protection Act, 2019.

Documentation and Transparency

The study shall create a comprehensive metadata for each dataset, detailing data collection methods, processing steps, and any transformations applied. In regards to version control, the researcher shall maintain detailed records of data versions, including dates and descriptions of changes, to ensure transparency in data handling. The study shall follow a Data Management Plan (DMP), by developing and regularly updating the DMP outlining procedures for data collection, storage, processing, and sharing.

13. Inclusion and Exclusion Criteria

Inclusion Criteria: Individuals aged 18 and above who are involved in housing development, policy-making, architecture, or residents with experience in sustainability of housing practices in Kenya are eligible to participate.

Exclusion Criteria: Individuals under the age of 18 or those without any direct or indirect experience related to housing in Kenya are not eligible to participate.

14. Research Result Dissemination

Effective dissemination of research findings is crucial to ensure that the insights from this study on the Impact of Housing Approaches, Policies, and Design Strategies on Sustainability of housing in Kenya, reach relevant stakeholders and inform policy and practice. The following outline gives a comprehensive approach of how the study results shall be disseminated:

i). Confidentiality of Results

Your individual data will remain confidential, and results will be reported in a way that protects your identity. There will be no disclosure of any personal information associated with your participation.

ii). Summary of Findings

After the study has concluded and data analyzed, a summary of the findings shall be shared with all participants. This summary will be written in clear, accessible language to ensure you understand the results and their implications.

iii). Academic Publications

The study shall submit articles detailing the study's methodology, findings, and implications to peer-reviewed journals focusing on housing policy, sustainable development, and urban planning. This will contribute to the academic discourse and ensure the research is accessible to scholars and practitioners.

iv). Conferences and Workshops

The results of the study shall be presented at national and international conferences related to housing, sustainability, and policy development. This will facilitate knowledge exchange and networking with other researchers and professionals in the field.

Workshops shall be organized with stakeholders, including policymakers, urban planners, architects, and community leaders, to discuss the research outcomes and explore practical applications.

v). Policy Briefs

Resulting from the study, policy briefs shall be prepared in the form of executive summaries. The researcher shall develop concise policy briefs that highlight key findings and recommendations, tailored for policymakers and government agencies. These shall be written in clear, non-technical language to facilitate understanding and

action.

5. Community Engagement

Efforts shall be made to host community meetings to present findings to residents and local stakeholders, to ensure that the research addresses community needs and perspectives. Following these open forums, the study shall establish channels for community members to provide feedback, fostering a two-way dialogue that can enhance the relevance and impact of the research.

6. Media Outreach

If resources allow, the study results shall be distributed through press releases to local and national media outlets to announce significant findings and their implications for sustainability of housing in Kenya. During the press release the researcher shall make a media appearance and engage with journalists for interviews on television, radio, and podcasts to discuss the study's outcomes and their relevance to current housing challenges.

7. Institutional Repositories

The final research reports shall be deposited with the Strathmore University Library to for open-access institutional repositories to ensure long-term accessibility and visibility.

9. Capacity Building

Training Sessions shall be organized to offer training for local government officials, planners, and developers on implementing sustainability of housing strategies informed by the research findings.

10. Access to Results:

The respondent has opportunity to request a copy of any published materials resulting from this study. Please provide your contact information on the consent form if you wish to receive these updates.

Appendix XI: Item-Total Statistics

Item	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
How long have you been involved in housing-related matters in Kenya?	99.5175	319.312	-0.117	0.927
In which area of housing are you involved?	99.5322	315.487	-0.027	0.927
How would you rate your knowledge of sustainability of housing practices	98.7515	313.137	0.060	0.923
National housing policies have significantly enhanced the development of sustainability of housing.	99.3684	293.107	0.595	0.917
The Affordable Housing Programme (AHP) has significantly improved sustainability of housing development.	99.8041	292.897	0.553	0.917
The National Urban Development Policy (NUDP) has effectively led to sustainable urbanization.	99.6345	294.784	0.581	0.917
Government policies have effectively promoted Public-Private Partnerships.	99.4298	296.480	0.529	0.918
Building maintenance policies have significantly enhanced the development of sustainability of housing.	99.7105	294.259	0.563	0.917
Public participation is adequately incorporated in the development of housing policies and programs.	99.9971	297.704	0.415	0.919
Government policies are adequate for sustainability of housing development.	99.8860	293.497	0.573	0.917
Legislations governing land use (e.g. Land Act, Urban Areas and Cities Act) are contributing for sustainability of housing.	99.5175	293.857	0.626	0.916
Legislations related to housing development (e.g. Housing Act Cap. 117, NCA Act of 2011 and Affordable Housing Act of 2024) are contributing to sustainability of housing.	99.4591	289.985	0.718	0.915
The Public-Private Partnership Act contributes positively to sustainability of housing initiatives.	99.4211	294.092	0.571	0.917
There are adequate institutions to drive sustainability of housing.	99.1725	292.149	0.556	0.917
Building codes enforce sustainability standards in housing.	99.0409	288.931	0.654	0.916
There are adequate capacities (e.g. managerial, material, technical and skills) to drive sustainability of housing.	99.1111	292.357	0.549	0.917
Existing framework of laws, regulations and institutions is adequate for sustainability of housing development.	99.3333	291.713	0.563	0.917

Public housing developments by national government agencies (e.g. the outright sale, rental and tenants' purchases schemes by NHC and NSSF) and county governments have contributed to sustainability of housing.	99.2602	292.287	0.624	0.916
The Kenya Slum Upgrading Programme (KENSUP) has improved urban living standards and contributed to sustainability of housing.	99.5673	295.015	0.593	0.917
Employer-assisted housing schemes, such as the Civil Servants Housing Scheme Fund, have enhanced sustainability of housing.	99.2281	293.449	0.598	0.917
Private sector housing development and community-led initiatives (e.g. cooperatives and self-built housing) are contributing to sustainability of housing.	98.8509	296.778	0.513	0.918
Financial systems and institutional housing approaches (e.g. KMRC, employer-assisted schemes) have incentives for sustainability of housing development.	99.2632	296.060	0.524	0.918
The self-built and incremental housing are viable and affordable solutions to housing sustainability.	98.9211	298.184	0.440	0.919
Generally, existing housing approaches are adequate for promoting sustainability of housing.	99.6170	293.803	0.554	0.917
Passive design strategies (e.g. natural ventilation and solar energy utilization) enhances sustainability of housing.	98.3743	297.601	0.564	0.917
Use of green building materials (e.g. bamboo and green cement) enhances sustainability of housing.	98.6520	295.442	0.534	0.917
Water conservation systems (e.g. rainwater harvesting, waste water recycling) improve housing sustainability.	98.4181	296.256	0.548	0.917
Green infrastructure (e.g. green roofs, urban parks) enhances community social well-being and sustainability of housing.	98.3918	297.353	0.543	0.917
Smart home technologies (e.g. Internet of Things - IoT i.e. enabled monitoring and BIM) improves energy efficiency, security, convenience, maintenance and overall sustainability of housing.	98.4269	296.093	0.583	0.917
Adoption of modern construction techniques (e.g. modular housing, Light Gauge Framing Systems (LGFS) and prefabrication) enhances sustainability of housing.	98.5380	295.727	0.584	0.917
Generally, housing designs (e.g. sizes, configurations, typologies and materials) are determinants of sustainability of housing.	98.4532	296.600	0.557	0.917
Overall Cronbach's Alpha (31 Items)				0.920

Appendix XII: Focus Group Discussion Pictorial