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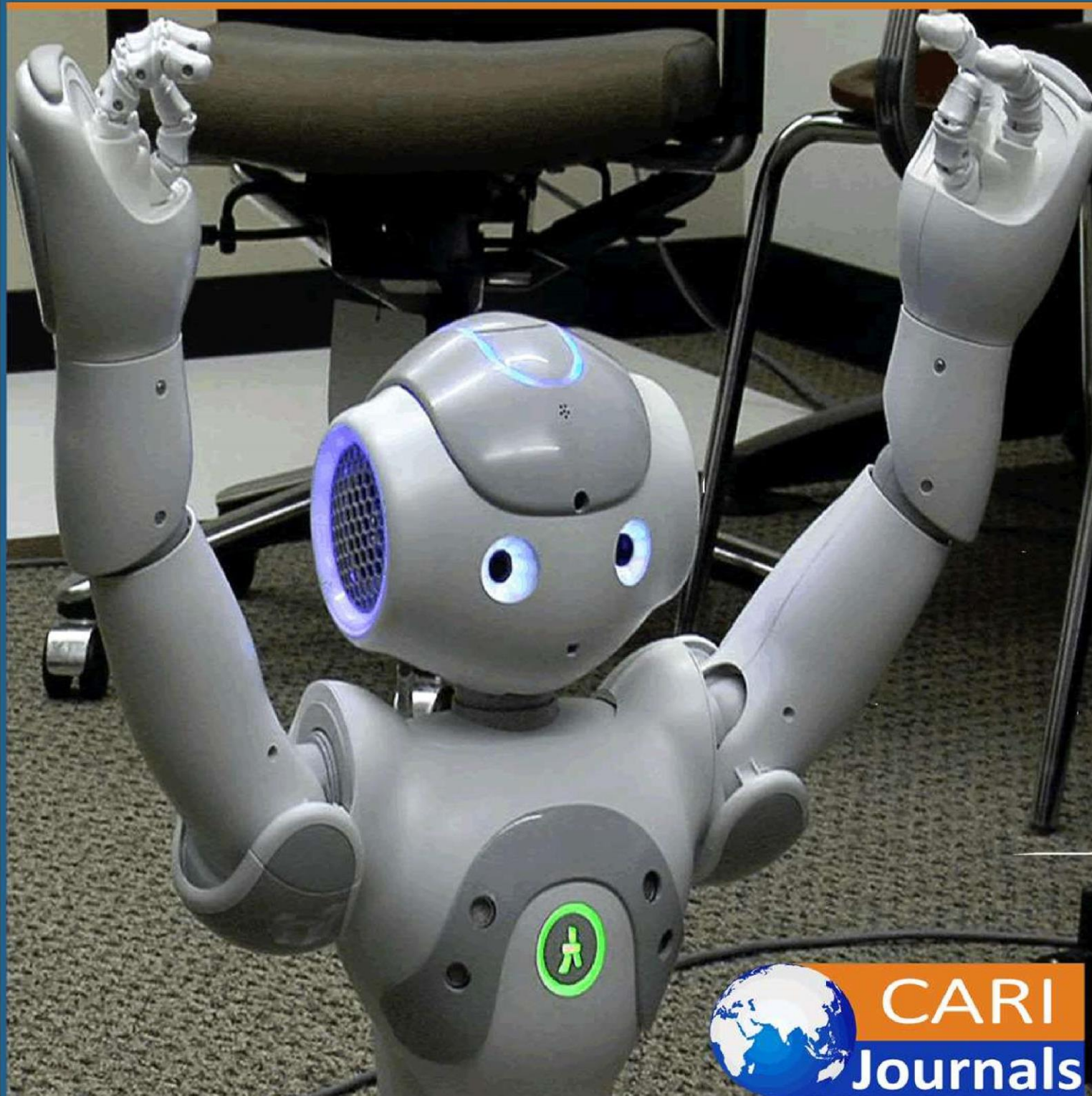

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An Evaluation of Kenya's Climate Change Policy Challenges for the Building Industry Toward the Realization of Netzero Emissions

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Abstract

Purpose: Climate change (CC) caused by global warming has become a significant problem today. Although Kenya has established several regulations and policies to deal with the impact of climate change and reduce its nationally determined contribution to near zero as committed in the Paris Agreement, there has been an increase in Co_2 emissions, especially from the building industry. Therefore, this research aims to evaluate Kenya's CC legal and regulatory framework, investigate challenges in Kenya's CC regulatory policies, and propose practical strategies for the climate changepolicy challenges for Kenya's building industry to reduce GHG emissions.

Methodology: The researcher conducted thorough literature reviews. Secondary qualitative data was collected from government policy documents in various ministries, peer-reviewed papers, international treaties, and working papers from International Non-Governmental Organizations and extensively analyzed using a mixed data analysis strategy.

Findings: Results from the analysis revealed that Kenya's CC regulatory framework for the building industry is inadequate, not overarching, and has limited effects on practices and processes in the building industry, thus, the continued increase of GHG emissions. There are no specific industry policies to target their processes and practices, poor implementation and enforcement reduce the effectiveness of the policies, and inadequate funds lead to inept policies and inadequate skills.

Unique contribution to theory, practice, and policy: The paper not only contributes Literary Knowledge to the subject area of climate change but also offers policy instruments that can be used as part of NCCAP to assist in CC policy formulation for the building industry.

Keywords: *Climate change, Global warming, policy framework, Paris Agreement*

INTRODUCTION

1.1 Research Background

Although Kenya's climate change policy formulation to counter the effects of global warming have seen remarkable progress in the past decade, recent studies (United Nations framework convention on climate change, 2021), have noted increased GHG emissions. The ballooning population and rapid economic growth have recently pushed the need for more infrastructure developments. The government development policy framework, vision 2030, which is expected to steer the country to a middle-level economy by 2030, has emphasized developing affordable mass houses for the larger population and upgrading other infrastructure like roads, rails, hospitals, bridges, and public buildings among others (GOK, 2017). Research by the United Nations framework convention on climate change (UNFCCC) asserts that such developments, if not done sustainably, will quickly enhance the country's contribution of GHG emissions to unprecedented levels leading to advanced effects on CC (UNFCCC, 2021), is worth noting that Kenya continues to suffer immensely as a result of climate change caused by global warming. Frequent floods, droughts, and changing weather patterns associated with global warming have altered the country's economic and social fabric (Longa & Zwaan, 2017).

The Government of Kenya (GoK) is one of the countries that adopted the Paris Agreement at Conference of Parties (COP21) and has committed to reducing GHG emissions to near zero levels by 2050 (GoK, 2015). Kenya continued to implement robust plans for climate change adaptation and mitigation measures. It was the first country in Africa to enact legislation creating a legal framework in response to climate change. The climate change act 2016 is Kenya's regulatory framework to provide a roadmap to achieve low-carbon climate developments and enhance climate change mitigation (Kenya Law Reforms, 2016). In her Nationally Determined Contribution (NDC), GoK has

promised a 30% reduction of GHG emissions by 2030. Kenya's Second National Communication (SNC) to UNFCCC pledged to reduce her emission level from 141MtC_{02}eq to just under 100MtC_{02}eq by 2030 (GoK, 2015).

Research shows that the building industry is responsible for about 40% of the total energy used globally and over one-third of GHG emissions in all developed or developing countries (Wen *et al.,* 2015; Cao *et al.,* 2016). There exists a great opportunity in Kenya's building industry to deliver long-term and sustainable GHG emission goals for the country. The climate change act 2016 builds on the National Climate Change Action Plan of 2013 (NCCAP), a plan started in 2013 to ensure Kenya's development goals are anchored firmly in law geared towards low carbon emissions and sustainability. The Plan is revised every five years to incorporate new realities and is now in its second edition, NCCAP 2018-2022 (GoK, 2015). Although having the potential to reduce GHG emissions by up to 40%, there are no precise policy instruments for the building industry in NCCAP that can be relied upon by the industry's stakeholders to align with the country's CC and sustainable development goals. The study is therefore expected to evaluate Kenya's CC legal and regulatory framework, investigate the challenges in Kenya's CC policy framework in the building industry that hinder the reduction of GHG emissions, and identify green policy strategies for use in Kenya's building industry toward the reduction of GHG emissions.

1.2 Significance of the Research

Kenya has adopted and committed to the Paris Agreement on CC, which requires every Nation to bring down her GHG outflows to Net zero before 2050. As a result, Kenya enacted the climate change act of 2016. It established NCCAP as a guide towards mitigating the effects of climate change and aligning all development plans with her sustainability goals. Currently, there are no clear CC policy instruments in NCCAP for the building industry that could be used as a standard by the stakeholders to ensure all the activities and processes in the building industry are sustainability conscious, there is therefore, a need to have a CC policy instruments for the building industry that can be included in NCCAP to be used as a guide in helping the industry play a critical role in reducing GHG emission thereby moving Kenya closer to meet her obligations as outlined in Paris Agreement on climate change.

1.3 Problem Statement

Kenya has recorded a steady progress in creating climate change legislations in the past decade not only to counter the effects of climate change, but also to reduce her GHG emissions to net zero by 2050 as committed in Paris Agreement. However, recent studies (UNEP, 2021, UNFCCC, 2021) have noted increased GHG emissions in the building sector, although climate change act of 2016 established NCCAP as a framework to guide all climate change policy formations to mitigate CC effects and reduce GHG emissions, there is no clear climate change policy instruments in NCCAP for the building industry to be used as a standard by the stakeholders to guide activities and processes in the industry towards sustainable development.

The absence of the CC policy instruments in NCCAP has led to increased GHG emissions from the building industry (UNEP, 2021), reducing the country's chances of meeting its net zero commitments in the Paris Agreement. Therefore, Kenya's building sector needs climate change policy instruments in NCCAP to guide building processes and activities to reduce GHG emissions and help the country realize its Net Zero ambitions by 2030.

1.4 The Aim

To Evaluate the challenges of Kenya's CC policies that hinder the realization of NetZero emissions and recommend effective strategies to reduce GHG emissions in the building sector.

1.5 Research Questions:

The research is expected to answer three questions as outlined below:

1. What is the CC legal and regulatory framework in Kenya?
2. What are the challenges in Kenya's CC policies hindering the reduction of GHG emissions in the building industry?
3. What strategies could be deployed in Kenya's building industry to help reduce GHG emissions?

1.5 Objectives

1. To Evaluate Kenya's CC legal and regulatory framework
2. To Investigate challenges in Kenya's climate change legal and regulatory policies hindering the realization of Net zero emissions.

3. To identify green strategies for use in Kenya's building industry toward reducing GHG emissions.

1.6 Scope of the research

The research intends to investigate the challenges facing the climate change policy regime in Kenya's building sector and propose green strategies that the policymakers can apply to the building industry, helpful in reducing GHG emissions.

2.0 LITERATURE REVIEW

The chapter focuses on an extensive survey of the research on GHG emissions in various countries. It applies the principles of Advocacy coalition theory (ACF) to analyze Kenya's legislative policy framework on climate change. The ACF is a strong and proven framework that illuminates our perception of climate change policy frameworks and effectiveness of policy implementations by bringing consciousness to how individual actors in the policy framework influences the effectiveness of policy outcomes (Gabehart et.al, 2022). The study uses the ACF as a tool to analyze and understand an issue through standardized conjecture in approaching complexity that ushers shared gains in knowledge that maybe used to inform policy change. This is an important viewpoint for understanding climate change policy, as coalitions comprise the political forces that drive policy change or status at international, national, or county level. The study evaluates Kenya's policy and regulatory response to the building industry's contribution to Kenya's NDC, and strategies to reduce GHG emissions.

2.1 Kenya's Climate Change Legal and Regulatory Framework

The CC laws are enshrined in Kenya's 2010 constitution and supported by various sector-specific policies. According to Article 2(6) of the Constitution and treaty ratification act 2012, several international CC laws and treaties have been imported into Kenya's CC laws and policies (Constitution, 2010). Below are some laws, regulations, and policies governing CC and steering Kenya into a carbon-free economy.

2.1.1 The Constitution of Kenya, 2010

Kenya's Constitution elaborates national principles and concepts of governance, including sustainable development in article 10, articles 42, 69, and 70 guaranteeing everyone a right to a decent environment, sustainable use, conservation of natural resources, and providing actionable means of compensation to those deprived of these

rights. From these laws, the "climate change act of 2016" derives its mandate (Naeku, 2020).

2.1.2 Climate change act of 2016

According to Naeku, (2020) the act aims to set a regulatory structure for a faster response to the effects of CC and provide measures to undertake developments that are resilient to climate change while promoting low-carbon sustainable developments. Naeku asserts that the act arrogates the mainstreaming approach and is the legal foundation for NCCAP enabling climate change actions and activities. It also allows the formation of a national climate change council (NCCC)and the establishment of operationalization of a climate fund.

2.1.3 United Nations Framework Convention on Climate Change (UNFCCC)

In her SNC to UNFCCC GoK states that it believes that CC is a global problem that requires a global solution. Therefore the country has participated actively in ratifying international agreements and treaties. The global response to CC was established on the UNFCCC that came into force in 1994. Kenya signed the UNFCCC in 1992 and ratified the Agreement in August 1994. The country is a frequent participant in conferences of parties (COP) (GoK, 2015).

2.1.4 The Paris Agreement

The Agreement aims at reducing carbon emissions to below 2^0 C pre-industrial level by 2050. Kenya ratified the Paris Agreement on 26 December 2016 under section 9(1) of the Treaty-making and ratification act of 2012, and it now forms part of Kenya's CC laws (GoK, 2018)

2.1.5 National Climate Change Action Plan (NCCAP)

The NCCAP is derived from the climate change act 2016, which obligates the GoK to develop actionable plans that can guide mainstreaming CC into sector functions. Naeku (2020) asserts that NCCAP was established to enhance Kenya's sustainable development targets by issuing reliable techniques to realize reduced carbon resilience development. To formulate policies NCCAP works with various actors, including government regulators, private citizens, Academia, the private sector, private citizens, and development partners.

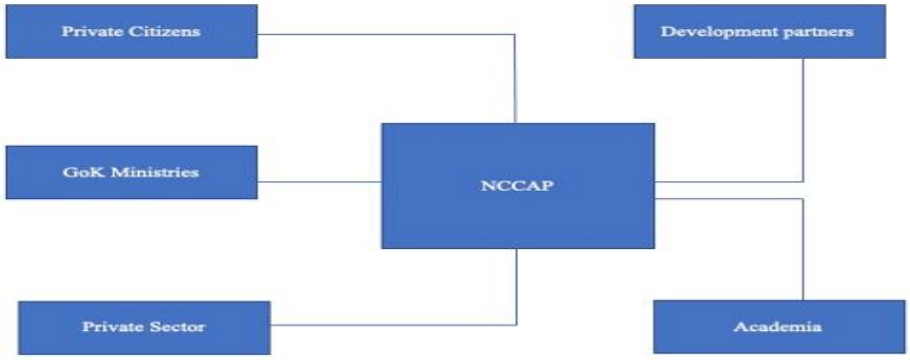

Figure 1: Shows actors in the National Climate change action plan, adapted from (Naeku, 2020)

The legal and regulatory framework of Kenya's climate change can be summarized in Figure 2 below.

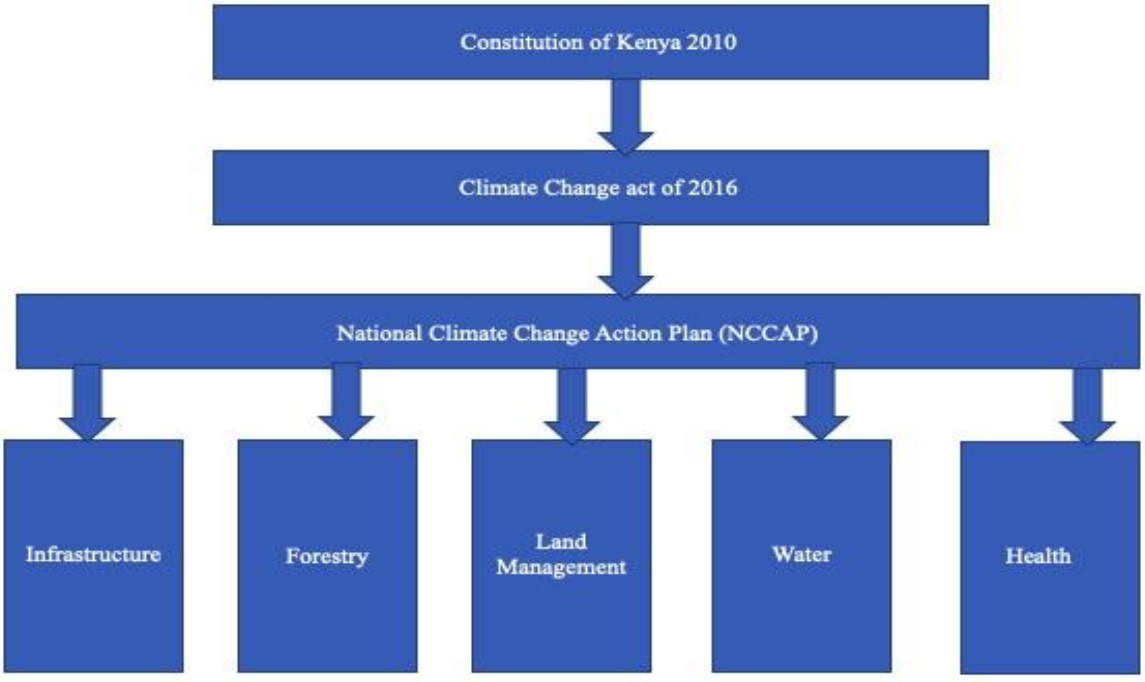

Figure 2: Kenya's regulatory framework, the conceptual flow of policy development (Wambua, 2019)

2.2 The challenges with the CC regulatory policies in Kenya

Although Kenya has attempted to create several CC regulations and policies in the past decade, a recent report from the United Nations Environmental Program (UNEP) has questioned the CC policies' effectiveness and if they are indeed working toward a carbon-free goal. The report posits that, even though the country had reduced GHG emissions between 2019 and 2021, it had noted a substantial increment in 2022 (UNEP, 2022). It adds that the low emissions reported in the years 2020 and 2021 could be attributed to the effects of covid 19 pandemic since most human activities were extensively reduced during this period.

In a paper prepared for a CC working group organized by the NCCAP council, the Kenya private sector alliance (KPSA) -a body that lobbies for conducive policies and legislation for private companies in Kenya identified thirty-eight barriers to effective implementation of CC policies, six of which were determined to affect CC policy implementations in the building and construction industry (KPSA, 2014). The six barriers listed by KPSA were insufficient information on building resilience and climate-proofing business operations, inadequate policy and regulatory frameworks to guide climate risks assessments leading to poor adaptation outcomes and low business competitiveness, poorly coordinated policy frameworks that do not address gaps hence limiting actions on CC programs, unavailability of technical assistance to CC related programs, lack of financing programs or information on carbon financing projects and Institutional technical and human capacity gaps (KPSA, 2014;UNEP, 2021). Wambua, (2019) has grouped Kenya's CC challenges into three broad categories: regulatory, institutional and industry.

2.2.1 Regulatory challenges

These challenges are associated with the legal regime, including CC laws, regulations and regulators, governance systems, and policies (Averchenkova *et al.,* 2019). Kenya has a devolved system of governance having one national government and 47 county governments, Kithiia & Dowling (2010) assert that even though climate change policies have been created by several entities within the federal government including the national management regulatory authority (NEMA), NCCAP, among others, there has been minimal effort to downstream the same to the 47 counties, this has led to noncompliance in the downstream governments, he emphasizes the urgent need to have county governments included in the implementation of CC policy programs, Naeku, (2020) suggests capacity building for the county government staff, downstream of regulators to county governments and creation of climate change enforcement fund to facilitate

implementation. He identified ambiguity in governance and overlapping legislation at the national and county governments, and suggested policy harmonization for smooth performance and actionable programs.

Wambua, (2019) argues that Kenya's climate change policies are incoherent. The foundation base of the laws, which is the Constitution, does not explicitly mention climate change, nor does the country's development blueprint, vision 2030. According to Wambua, even though Vision 2030 has plans to develop massive infrastructural transformation and turn around the economy, it only talks of sustainable development but does not provide a framework to get to sustainable development. This has led to several flagship projects within the blueprint being developed without necessarily considering sustainability.

2.2.2 Institutional Challenges

Naeku argues that most institutions created by NCCAP to develop and regulate climate change programs have inadequate human and technical capacity to create and implement CC programs. He recommended training staff on CC effects to enhance a deeper understanding of global warming and climate change, further training on technology is required on alternative materials and supervision on green products, and further need to understand how to create and implement environmental products declarations (EPD) is necessary for the manufacturer who is trading or promoting green products (Naeku, 2020).

Many policies and regulations have been set in various countries to mitigate or adapt to climate change. Unfortunately, there is slowness in the actual implementation of the policies. Some studies (Averchenkova *et al.,* 2019; Murphy, 2022) have blamed the apparent laxity of implementing the policies on funding, while others (Roeser, 2012) argue for the absence of political goodwill. Nachmany *et al.* (2014) investigated climate change laws and policies in 66 countries and found that only one-third of the countries were implementing the policies. Most of them were big on paper and little on practicality.

2.2.3 Industry challenges

The policies lack a framework for funding green projects, and the local banks are very costly and charge hefty interest rates discouraging industry players from seeking financing (Murphy, 2022).Kenya private sector alliance argues that climate change policies have no funding prepositions for the industry, and the few ones are weak and not

easily implementable. They posit the lack of information sharing on low carbon funding as a significant challenge as the players lack information. Even the little that could be useful has not been communicated. The study suggests creating an adequate climate change policy framework for specific sectors that could be useful for sustainable development and reducing global warming (KPSA, 2014).

Resources and funding allocations for green projects have become problematic. Alqadami *et al.* (2020) observe that first, there is a perception within the industry that sustainable construction is expensive and requires a significant initial investment. Lu *et al.* (2020) agree with this line of thinking and argue that even-though green buildings could lead to higher profits for developers, the initial investments in materials and machinery are approximately 20% higher than in non-sustainable materials.

According to Schlanbusch *et al.* (2016), There have been efforts to have building material manufacturers label their products with environmental product declaration (EPD), which displays accurate and verifiable environmental information about a product throughout its life cycle. Schlanbusch argues that most climate change policies in developing countries lack EPD regulations and thus continue to use products with excessive GHG emissions creating a business as- usual scenario.

Dowson *et al.* (2012) hold that the building industry is labor-intensive and highly technical. They contend that for years the industry has been plagued by a lack of skills and technicalities to perform their roles efficiently, and this has seen it lagging in adopting new technologies and innovations that could easily be used to reduce co_2 emissions. Dowson *et al.* (2012) gives an example in the United Kingdom where, despite having new technologies like building information modeling, green solutions, etc., the sector has been slow in adoption and has led to continued use of old technologies, which emit excessive co_2. They argue that sometimes policy frameworks must be followed by strict implementation guides and burdensome regulations to get results.

2.3 Strategies

UNFCCC advocates for a united industry to form common strategies to reduce GHG emissions. According to UNFCCC the strategy must consider the complexity and disjointed nature of the building industry if they are to be effective (UNFCCC, 2021). Kibwami &Tutesigensi (2016) suggested a system-thinking strategy. They argue that the net effect of reduced carbons will be negligible unless a building project's entire lifecycle

is considered. Giving Uganda as a reference, they argued that most developers concentrated reduction of GHG from operational aspects of development, ignoring embodied carbons, yet a higher percentage of GHG emissions come from embodied carbons.Hashemi and Cruickshank (2015) agree and argue that strategies that consider the building's life cycle could be more effective in reducing GHG emissions.

Various strategies have been suggested to reduce GHG emissions (Gernaat &Forsell, 2017; Ali *et al.,* 2019; UNEP, 2021). A paper by a working group for UNEP argued that effective strategies in the building sector must be based on four actions: avoid, shift, improve, and adapt. Avoid all materials that lead to emissions of GHG, change production methods to embrace sustainability, improve project development processes to low carbon emissions, and adopt sustainable practices, including recycling, re-use, and reducing (UNEP, 2021). Ali *et al.* (2019) classified these strategies into four broad groups (standard and policy formulation, Impact assessments, use of low-carbon technologies, and transform the industry

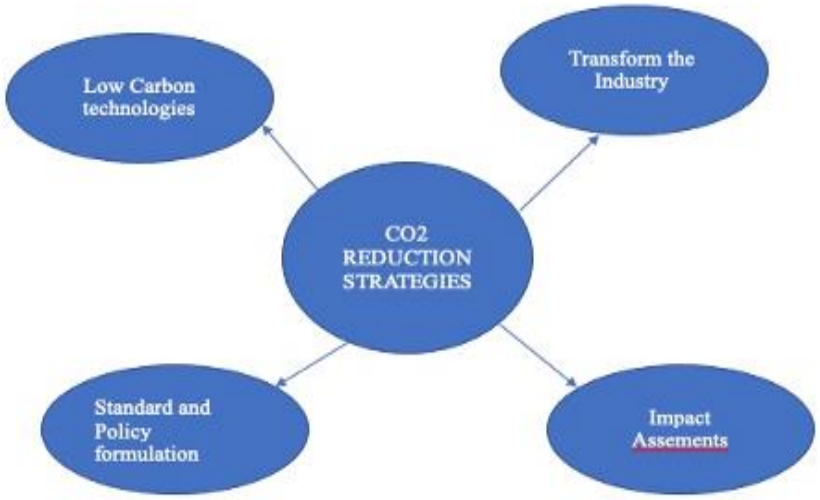

Figure 3: Strategies that reduce GHG outflows in the building industry (Ali *et al.,* 2019)

2.3.1 Formulating Standards and Policy

According to Nachmeny et al. (2019), many countries have formulated building codes, working standards, and policy guidelines worldwide to reduce their emissions under the Paris Agreement. Elzen *et al.* (2022) report that as many as 156 countries had issued their

Nationally determined contribution (NDC) at the end of 2021. The table below shows sample building industry climate change policies for selected countries.

Table 1: Sample standards, policies, and laws reducing GHG emissions in the building sector around the globe (Elzen, *et al.*, 2022)

Sweden	Introduced a certification scheme to deal with environmental impact for new buildings in 2019.
Japan	Introduced energy efficiency act in 2017 as part of government zero energy house initiative.
USA	California introduced building energy efficiency standard code in 2019
Nigeria	Introduced building energy code in 2017 set minimum standards for energy-efficient buildings
India	Introduced a policy in 2016 as part of energy conservation act of 2001, targeting reduction of energy in commercial buildings.

2.3.2 Adoption of low carbon technologies:

Mulligan *et al.* (2014) recommend motivating developers and contractors to use low-carbon technologies. These include using materials with low carbon counts, including renewable materials and sustainable energy technologies, such as cooling, passive ventilation, and solar systems, for generating heat energies. Mulligan posits that adopting such in the building sector has been proven to reduce emissions and enhance energy savings in new buildings. However, Nikyema & Blouin (2020) disagree and posit that adopting low-carbon technology increases the operational costs of such structures. There is a need to balance the reduction of GHG and the adoption of innovative technology. They argue that some green technologies are costly regarding materials and processes. More often than not, new technologies require new skills that are usually unavailable or too costly.

2.3.3 Impact Assessments of buildings processes and Materials

Building processes start with extracting raw materials, manufacturing, transportation, use,

and demolition (Sudarsan, 2022). Understanding these processes is critical in calculating a project's energy consumption and GHG emissions. Quantifying co_2 emissions from the entire building lifecycle is significant in understanding its contribution of GHG to the environment. A study by Ruuska & Häkkinen (2015) analyzed building materials used and linked them to GHG emissions. It found that certain materials like concrete and steel emitted more GHG than others, and it advised careful selection of materials with lower carbon footprints. Ruuska & Häkkinen posit that an appropriate choice of materials could reduce co_2 emissions by over 25% in the lifespan of the building. Even though the building industry has made some progress towards sustainable developments, concentration has been on the building's operational aspects, leaving out all other processes of putting up the building and forming embodied carbons. Ruuska & Häkkinen submit that embodied carbons in the building industry have the highest percentage of carbon emissions compared to operational carbon. It is, therefore, empirical that the assessment of raw materials is done to quantify the number of embodied carbons in its entire life cycle. This assessment could simplify the evaluation of environmental impact assessment and aid in creating EPD products, they conclude.

2.3.4 Transform the industry:

Karlsson *et al.* (2020) argue that incentivizing manufacturers in the building industry to produce green materials may lead to a reduction of GHG outflows in the sector by up to 20%, laws and policies should be created to enforce EPD and reward mechanisms put in place to the contractors that use EPD products. Karlsson asserts the need to change procurement policies that favor reducing, re-use, and recycling. Creating a clear funding framework for producing sustainable building materials should be part of climate change policies. A carbon trading framework should be developed, and sufficient information disseminated to all the stakeholders to understand how carbon trading works. Contractors must be encouraged to take Centre stage in creating development with low carbon footprints (Karlsson *et al.,* 2020).

3.0 RESEARCH METHODS

The pragmatism method has been used in this research, although interpretivism could be used to interpret policies, documents, and their effectiveness in reducing GHG emissions, it is too biased in its application of logic. It could be very restrictive in interpreting realities. From reviewed literature, GHG emissions need to be measured and counted to quantify the levels and value of outflows; indeed, the country is expected to measure and

report her NDC annually to the UNFCCC. These require numeral analysis where policy configurations are necessary. As such, the research deploys a mixed philosophical approach to allow innovation in interpreting the outcome.

4.0 RESEARCH FINDINGS

Kenya's legal and regulatory policies for climate change face various challenges that have seen a continuous increase in GHG emissions over the years despite the regulatory policies. The trend is reflected in Fig 4 below.

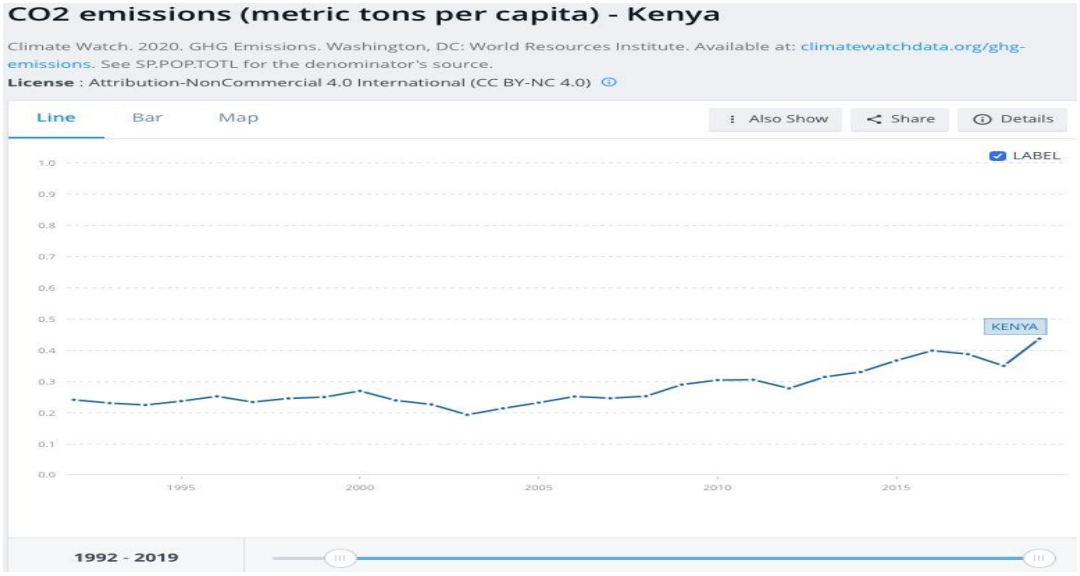

Figure 4: Co_2 emissions trends in Kenya from 1992 to 2019 (world bank, 2022)

These challenges are classified into three groups, namely regulatory, sectorial, and institutional challenges.

4.4.1.1 Regulatory challenges

The current laws, regulations, and policies are inadequate, not overarching, and have limited effects on targeted industry practices. NCCAP, the main climate change policy framework, does not have to build industry-specific policies that could reduce GHG emissions. As a result, the industry continues with business as usual. An example is manufacturing companies within the industry, including cement, paints, glass, ceramics, steel, iron, etc., that emit vast amounts of greenhouse gases during there production as there are no regulations or policies to transform them to sustainability. Although Kenya enacted energy act no 1 of 2019, which enabled the formulation of various laws to enhance the use of renewable energy in different sectors, there are no clear regulations in

the building industry hence the continuing use of old energy-consuming technology, an example is the law requires all new residential buildings to be fitted with solar heating equipment. Yet, enforcement of this has been a challenge to EPRA, (the body mandated to enforce these regulations). Enforcement of the laws is greatly affected by corrupt officials who take bribes and neglect their duties. Despite clear regulations, this has seen the infiltration of defective energy-consuming appliances from other countries.

4.4.1.2 Sectorial challenges

Although several climate change policies exist in other sectors, Kenya's building industry does not have specific policies targeting their practices or processes directly. Instead, the industry has been spread over various other sectors with disjointed policies and no proper implementation or enforcement framework. The lack of regulatory enforcement has led to substandard renewable materials. The policies have no funding framework for new technologies or industrial expansion into green development, The government recognized the funding challenges in their national climate change response strategy and suggested a raft of proposals to the UNFCCC to facilitate local private industry, but this is yet to materialize, the green solutions are perceived to be expensive and in an economy with more than 50%living below a dollar per day, the cost is of great concern when making decisions. The industry lacks the technical capacity to comply with the regulations, whereas additional training and capacity building is required on new technologies, including BIM, renewable energy, retrofitting, etc. The industry practitioners are slow to comply, citing competitive disadvantages that could push them off the market.

4.4.1.3 Institutional challenges

Various institutions have been created by both Kenya's climate change act of 2016 and the energy act of 2019. These include NEMA, EPRA, Rerec, NPEA, and EPT. There is a lack of coordination of activities among these institutions at the national and county governments, this has been complicated by the governance system with a federal government and 47 county governments, and mainstreaming of policies downstream has been a severe challenge. The institutions lack the enforcement capacity and technical skills required for renewable energy and green developments. Besides, there is rooted corruption within the institutions which hinders the adequate performance of their tasks—duplication of regulations and policies among the institutions and downstream county governments. Even though NCCAP created a framework for climate change funds, the rules and guidelines are yet to be actualized.

4.2 The strategies to decrease GHG outflows from the building industry

Strategies to be applied must embrace the complex, disjointed actors in the industry and consider the emissions from the entire life cycle in the building industry. Concerning the construction of low-carbon buildings for the future, there is a need to have a system-thinking design approach that considers the whole life cycle of the building. Infrastructural longevity requires incentivization both legally and financially to motivate low-carbon adaptations. The strategies must adequately address embodied carbon which has not been considered previously as of strategic importance despite their massive contribution to GHG emissions. The strategies must address in equal terms both operational and embodied carbons. These strategies can be described with four actionable words, Avoid, shift, Improve, and Adapt. Avoid High carbon emissions-prone materials like cement, ceramics, paints, metals, etc. There is a need for the project owners to take higher responsibility for their choice of material for the environment. To enhance better choices, data needs to be provided for the owners to understand the consequences of their options and make the right decisions at all project stages.

Shift the production methods, including excavation, transportation, and manufacturing, to embrace sustainability. Improve project development processes like planning and construction to lower carbon emissions. Adapt sustainability practices, including reducing, re-using, recycling, etc., in the lifecycle of the projects, which requires reduced materials and uses low-carbon matter, circular approaches, and enhanced designs with a longer lifetime.

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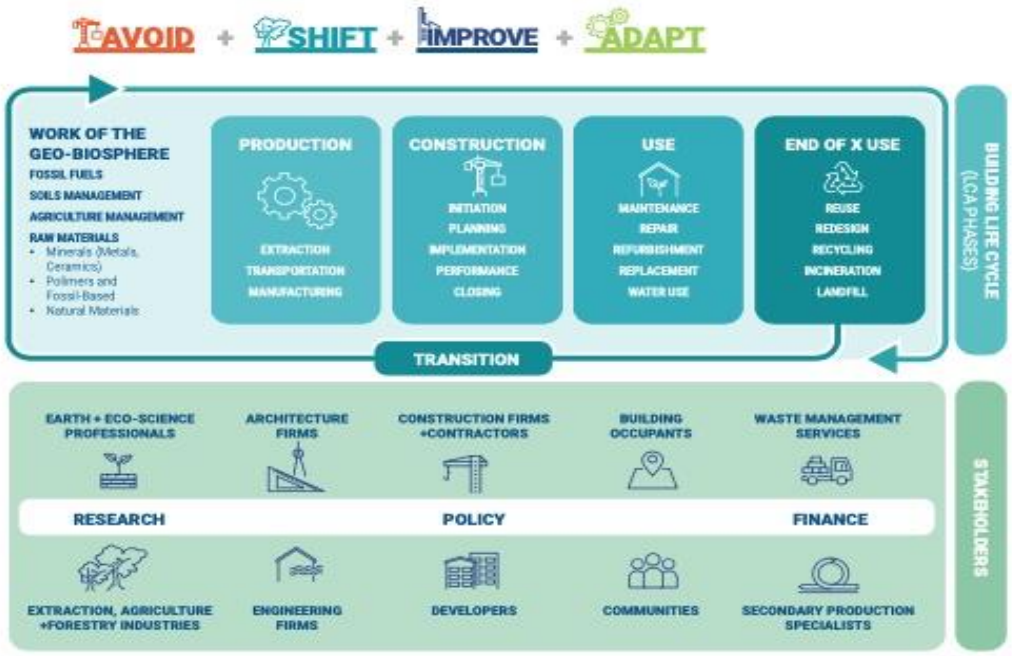

Figure 5: Shows actionable knowledge, getting the correct data to actors at the right phase in the project's life cycle for enhancing optimum decarburization by use of system thinking (UNEP, 2021)

The four action points yielded several strategies that could be used to decrease GHG outflows in the building industry. These have been classified into four categories and simplified in the table below.

STRATEGY	ACTIONS
Use of low-carbon technologies	Low carbon contained materials, renewable energy, cooling systems, re-use, recycle and reduce materials, low carbon designs and orientation, insulation techniques
Standards and policy formulation	Building codes, energy regulations, appliance standards, renewable energy regulations and policies, EPD procedures, green building certification schemes, Material selection policies, sustainable design policies, etc.
Industry Transformation	Policies to promote green development, enhance EPDs declarations in all products, change procurement policies, incentivize sustainable technologies, create funding mechanisms for green developments,

	creation of clear paths for information dissemination among stakeholders, change the organizational attitude towards sustainable developments,
Impact assessments	Create frameworks to quantify Co2 emissions, calculate and document carbon footprints in buildings, make building industry to document its share of NDC, quantify carbon contents of building materials to aid better procurement choices, Assess impacts of climste change policies.

Table 3: Shows various strategies to decrease GHG outflows in the building industry in Kenya

5.0 FINDINGS ANALYSIS

5.1 Practices and Processes in the building industry

The qualitative data analysis showed a direct connection between practices, processes, and activities in the building industry to significantly high GHG emissions. The emissions have increased over the past decade despite Kenya taking some strides to create regulations and policies to decrease the emissions and steering the country to meet its net zero obligations by 2050 committed in Paris Agreement (UNEP, 2022; Naeku, 2020; Murphy, 2022). The study looked at the emissions from both embodied and operational carbon and found that the industry's contributing share of GHG in NDC is approximately 40%, with embodied carbons accounting for 10%, while building operations contribute up to 30% of GHG emissions (Kibwami & Tutesigensi, 2016; Wambua, 2019).

The research observed and noted standard practices in the building industry with significant GHG emission contributions, including cement, steel, and ceramics manufacturing processes, use of fossil fuels in the excavation, transportation, and construction processes, use of heavy machinery during construction and demolition, construction waste management practices and sewage disposals (UNEP, 2022; Ali *et al.,* 2019). Moreover, the research found that infrastructure built using such materials as cement, steel, ceramics, etc., led to the production of unsustainable developments having large amounts of carbon footprints that will continue to contribute to global warming for an extended period (Elzen et al., 2022; Nikyema & Blouin, 2020).

Using nonrenewable energies for lighting, heating, and cooling systems in buildings

contributed heavily to high energy consumption and GHG emissions. The research found that although Kenya had enacted specific laws and regulations to deal with operational carbons through the energy act of 2019 together with its policies, most developments had not adhered to the policy and continued with the use of unsustainable practices contrary to the regulations, for example, the policy required all new buildings to be fitted with solar water heaters, the research found that the developers were not observing this, other policy requirements like energy specification and standards for appliances were facing enforcement challenges due to other factors like corruption (Naeku, 2020; Ongugo *et al.,* 2014).

5.2 Regulatory Architecture

Although Kenya has a robust climate change regulatory architecture in place meant to spearhead the country's development plan toward a low-carbon nation, The study found that these laws, regulations, and policies are dogged by many challenges (Naeku, 2020; Alqadami, *et al.,* 2020). The challenges have primarily contributed to the ineffectiveness of the policies. A review of the governance structure found that Kenya has a devolved system of governance with the national government developing policies, and the research found that there is no framework for mainstreaming the guidelines from the national government to 47 county governments this was found to hamper enforcement of the policies downstream across the country (Averchenkova *et al.,* 2019; Murphy, 2022). NCCAP and energy act of 2019 has created several regulatory entities that are meant to implement and enforce the policies, the study found these entities to lack the required capacity needed to implement the policies, and rampant corruption was noted to impact the effectiveness of policy implementations. The study found lack of coordination between the regulators and national and county governments often leads to enforcement collision and duplication of regulations (Alqadami *et al.,* 2020, KPSA, 2014). Even though some regulations were good, they required technical know-how, often lacking among the regulators. The research recommended a study on the effectiveness of sectorial policies to measure their effectiveness towards the reduction of GHG emissions

5.3 Strategies

The research evaluated various strategies that can be deployed in the building industry to decrease GHG outflows. It found the effective way to reduce emissions in the industry is to apply system thinking. This approach was found to be capable of capturing all the disjointed actors and activities in the industry. System thinking enabled the creation of a

policy framework to take all the practices and activities in the building industry as one system and establish a framework that targets the system rather than individual units or organizations (Karlsson *et al.,* 2020). The study identified four actionable principles to guide the GHG emissions strategic planning, these are (AVOID+SHIFT+IMPROVE +ADOPT). The study established that the developers must avoid non-sustainable materials like cement, paints, ceramics, and fossil fuels when choosing building materials, shift the production methods and processes like manufacturing, excavation, transport, etc., to be aligned with sustainability, adapt sustainability principles including reducing the number of materials used, use of recycled materials like plastics as much as possible and re-use of materials to avoid escalating emission problem.

Although these strategies were found to have been effective in other parts of the world, the study doubted their ability to apply them in the Kenyan system due to the low adoption of sustainable construction in Kenya. It is challenging, for example, for developers to avoid the use of unsustainable building materials as they are not readily available in the local market, shifting to sustainable processes is deemed to be too expensive and no studies have been done to gauge the level of customer perception to buy the materials, even though adapting sustainable principles of recycle and re-use have been picking pace in the country the level of uptake and commitments by the government to promote these principles have not been practical and hence the difficulty in measuring results on their effectiveness. Nonetheless, the research found that integrating the strategies with a suitable policy framework and creating awareness of the opportunities could make an efficient strategic roadmap for the reduction of GHG outflows (Ali, *et al.,* 2019; UNEP, 2021; UNEP, 2022)

The study evaluated the life cycle of the projects in the building industry using system thinking. It developed various strategic policy instruments that can be implemented in the climate change policy framework to enhance sustainability in the building industry and move closer toward zero emissions. These were classified into four broad categories: use of low-carbon technologies, formulation of standards and policy, industry transformation, and assessment of the impact of GHG emissions. The research found that some of these policy instruments, such as declarations of EPD, building codes, green building certifications, creation and management of green funds, and quantification of co2, among others, have been very effective in other countries and could be easily localized in Kenya and achieve similar results. (Ali, *et al.,* 2019; Elzen *et al.,* 2022; Sudarsan, 2022).

6.0 Conclusions

The climate change regulations and policies in Kenya's building industry are dogged by several challenges that hinder them from reducing GHG emissions within the industry. These challenges can be classified into three broad categories: regulatory challenges, which are concerned with challenges faced by regulators and regulation procedures and policies, Sectorial which affect the building sector practices and processes and institutions, which affect various bodies and institutions that the regulatory regime, together with the governance system in place.

Robust strategies must be formulated to reduce GHG outflows in the building industry effectively. The strategies must utilize the system thinking approach to capture the entire systems, practices, and processes in the building industry using a life cycle analysis of the building's structure. Four actionable principles were identified to be effective. These are avoiding high carbon-rated materials, shifting production methods to sustainability, improving construction processes towards zero emissions, and adapting sustainability principles of reduction, re-use, and recycling. The strategies were identified and grouped into four broad categories, namely the use of low carbon technologies including in materials, cooling systems, renewable energy, etc., the formulation of standards and policy to have building codes, appliance standards, green buildings certifications, environmental product declarations, etc., Industry transformations include the development of green policies, change of attitudes, procurement policies, incentivization, creation of funds, etc., and impact Assessments including the design of frameworks to quantify co_2 emissions, document building industry share of emissions, assess impacts of climate change policies, etc.

6.1.1 Recommendations for future research

In order to measure or evaluate the effectiveness of policy instruments provided, there is a need to first quantify amounts of GHG emissions from specific industry actors activities and processes, and then quatify the cumulative industry contributions in order to determine the building sectors contribution of GHG in the NDC, therefore to achieve this a reseach to quantify and compare historical contribution of the industry is required

The success of the CC policy instruments largely depends on stringent policy enforcement and implementation, further research is needed to ascertain the

impact of government incentivization of the industry towards adoption and acceptance of the policies.

6.1.2 Theoretical contributions: - Climate change being a global challenge is a critical discussion area in today's literature. However, studies show limited literature on policies and regulations to reduce GHG emissions in Kenya or sub-Saharan Africa (Ongugo *et al*., 2014; Kibwami and Tutesigensi, 2016; Wambua, 2019). This paper, therefore, contributes to literary knowledge as it gives insights into the challenges of climate change policies in the building industry and how they can be overcome to reduce GHG emissions. The solutions provided in the research can be replicated in other countries, especially in Africa.

6.1.3 Practical Contributions: - The research's proposed climate change policy strategies for the building industry contribute to the ongoing policy formations in Kenya's NCCAP for sector-specific reforms. The framework provides a central point for planning, understanding, formulating, and implementing climate change policies for the building industry using a system thinking approach. This will help improve the effectiveness of climate change policies in the building industry, help the country reduce GHG emissions, and achieve its commitments to the Paris Agreement.

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