International Journal of Social Sciences and Humanities Invention 11(12): 8391-8400, 2024
DOI: 10.18535/ijsshi/v11i12.06
ISSN: 2349-2031
https://valleyinternational.net/index.php/theijsshi

Evaluating the Effectiveness of Kenya's National Green Finance Strategy in Achieving Sustainable Economy and Climate Goals.

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Abstract:

Kenya acknowledges the imperative of integrating green finance into its financial systems to combat climate change and promote environmental sustainability. Despite its commitment to a comprehensive green finance strategy, there remains a significant gap in understanding its actual impact. This study assesses Kenya's National Green Finance Strategy, focusing on its effectiveness in achieving climate goals by mobilizing green investments and influencing financial institutions to adopt sustainable practices. The primary variables studied include the alignment of financial policy and institutions with green finance principles and the mobilization of green investments. Grounded in Stakeholder Theory and the Theory of Sustainable Finance, the study employs a mixed-methods approach, integrating policy analysis, stakeholder interviews, and case studies. Initial findings highlight progress in fostering green finance while exposing deficiencies in regulatory frameworks, financial inclusion, and public awareness. Although the strategy has partially mobilized green investments, financial institutions have not fully embraced green finance principles. Regression analysis demonstrated high explanatory power ($R^2 = 0.9992$, Adjusted $R^2 = 0.9962$, F-statistic = 330.8, $p = 0.04121$), confirming the significant role of financial and institutional resources in mobilizing green investments. Granger causality tests revealed potential temporal dependencies between investment inflows and greenhouse gas (GHG) emissions, showing significant self-causality within GHG emissions data. However, GDP and renewable energy share showed no significant effects. The study concludes that addressing gaps in regulatory frameworks, enhancing financial inclusion, and raising public awareness are critical. Implementing these recommendations could fortify Kenya's green finance mechanisms, contribute significantly to global climate goals, and provide a model for other developing nations striving to align their financial systems with sustainability principles. By tackling these challenges, Kenya can unlock its full potential in mobilizing green investments, fostering institutional change, and driving the transition to a low-carbon economy. The study further establishes that the development of stakeholder engagement frameworks is necessary, actively engaging local governments, the community, and private investors in the design and delivery of green finance projects and ensuring participatory processes underpin the projects, a precept of Stakeholder Theory.

Keywords: Green Finance, Climate Goals, Sustainable Development, Financial Inclusion.

I. Introduction

Green finance is increasingly recognized as a crucial mechanism for achieving sustainable development and climate goals. It encompasses financial investments that deliver environmental benefits, including reducing carbon emissions, promoting energy efficiency, and fostering sustainable agriculture and forestry (OECD, 2017). As climate change poses significant risks to economies and societies globally, countries are developing green finance strategies to mobilize resources for climate mitigation and adaptation. Kenya, a country highly vulnerable to the impacts of climate change, has taken proactive steps to integrate green finance into its national development agenda. In recent years, the Kenyan government, in collaboration with international organizations and the private sector, has formulated the National Green Finance Strategy. This strategy aims to mobilize financial resources to support sustainable projects and promote an inclusive green economy. The strategy is aligned with Kenya's Vision 2030 and the country's commitments under the Paris Agreement, targeting significant reductions in greenhouse gas emissions and enhancing climate resilience (Government of Kenya, 2020).

The effectiveness of Kenya's National Green Finance Strategy can be evaluated through various lenses, including policy implementation, financial mobilization, and impact on climate goals. One critical aspect is the extent to which the strategy has facilitated access to climate finance from domestic and international sources. According to the United Nations Environment Programme (UNEP, 2021), effective mobilization of climate finance is essential for developing countries to meet their climate targets and transition to low-carbon economies. Another key dimension is the role of regulatory and policy frameworks in promoting green finance. The Central Bank of Kenya (CBK) has been instrumental in developing guidelines for green banking and encouraging financial institutions to integrate environmental risk management into their operations (CBK, 2019). Additionally, the Nairobi Securities Exchange (NSE) has introduced green bond guidelines to attract investments in environmentally friendly projects (NSE, 2020).

Despite these initiatives, challenges remain in scaling up green finance in Kenya. These include limited awareness and capacity among financial institutions, inadequate regulatory incentives, and the need for robust monitoring and evaluation mechanisms. Studies have highlighted the importance of building institutional capacity and fostering public-private partnerships to overcome

these barriers (World Bank, 2019). Given the strategic importance of green finance in addressing climate change, it is imperative to evaluate the effectiveness of Kenya's National Green Finance Strategy. This evaluation will provide insights into the successes and limitations of the strategy, offering valuable lessons for policymakers, financial institutions, and other stakeholders involved in the green finance ecosystem, (Ozili, 2022).

Global Perspective of Green Finance and Sustainable Climate Change

In recent years, Kenya has emerged as a leader in Africa in adopting a National Green Finance Strategy aimed at mobilizing financial resources to mitigate climate change impacts and transition to a low-carbon economy. The strategy aligns with Kenya's commitments under the Paris Agreement and its national development agenda, emphasizing sustainable development and climate resilience, (Chen, Zuo, Jin, Xu, Zeng, Zhao & Wan, 2022). Despite these ambitious goals, evaluating the effectiveness of Kenya's National Green Finance Strategy remains a critical challenge. Green finance has gained global attention as a pivotal tool for achieving sustainable development goals and climate targets. Countries worldwide are implementing various green finance strategies to mobilize resources for renewable energy, energy efficiency, sustainable agriculture, and other environmentally friendly projects. For instance, China has established the Green Finance Initiative to support green investments and promote environmental protection (OECD, 2021). Similarly, the European Union has launched the Green Deal, aiming to make Europe the first climate-neutral continent by 2050, with significant investments in green technologies and sustainable infrastructure (European Commission, 2020). Key to the success of these strategies is the mobilization of financial resources. According to the United Nations Environment Programme (UNEP), global investment in renewable energy and energy efficiency needs to triple by 2030 to meet climate goals, underscoring the importance of effective green finance mechanisms (UNEP, 2021). However, challenges persist, including limited access to climate finance, inadequate regulatory frameworks, and the need for enhanced public-private partnerships (World Bank, 2020). In Kenya, the effectiveness of the National Green Finance Strategy hinges on several factors. These include the mobilization of financial resources from domestic and international sources, the alignment of regulatory frameworks to support green investments, and the implementation of robust monitoring and evaluation mechanisms. The Central Bank of Kenya has played a crucial role in developing guidelines for green banking and integrating environmental risk management into financial institutions' operations (CBK, 2019). Additionally, the Nairobi Securities Exchange has introduced green bond guidelines to attract investments in sustainable projects (NSE, 2020).

Despite these efforts, challenges remain in scaling up green finance in Kenya. Limited awareness and capacity among financial institutions, as well as the need for innovative financing mechanisms, pose significant barriers. Studies suggest that integrating environmental, social, and governance (ESG) factors into financial reporting can enhance transparency and attract green investments (IFC, 2020; GRI, 2020). In conclusion, evaluating the effectiveness of Kenya's National Green Finance Strategy is crucial for understanding its impact on climate goals and identifying areas for improvement. By learning from global best practices and addressing local challenges, Kenya can enhance its green finance framework and contribute to global efforts to combat climate change.

Research Objectives

General Objective of the study

The General objective of this study will be to Evaluate the Effectiveness of Kenya's National Green Finance Strategy in Achieving Climate Goals

Specific Objectives

1) To evaluate the alignment and effectiveness of Kenya's green finance policies in Achieving Climate Goals
2) To examine the effectiveness of institutional frameworks and stakeholder participation in green finance towards achieving Climate Goals.

To assess the effectiveness of Kenya's National Green Finance Strategy, this study will address the following questions: How effectively has the strategy mobilized financial resources for green projects? What are the key regulatory and policy frameworks supporting green finance in Kenya, and how effective are they? What barriers exist in scaling up green finance, and how can they be overcome? By answering these questions, this research aims to provide actionable insights and recommendations to enhance the effectiveness of Kenya's green finance efforts and contribute to the broader global climate agenda.

Statement of the Problem

Climate change poses a significant threat to Kenya, manifesting in extreme weather events, prolonged droughts, and erratic rainfall patterns, which have severe socio-economic impacts on the country's predominantly agrarian economy. To address these challenges, Kenya has adopted the National Green Finance Strategy, aimed at mobilizing financial resources to support sustainable development projects, reduce greenhouse gas emissions, and enhance climate resilience. Despite the ambitious goals and the strategic importance of this initiative, there are concerns regarding its effectiveness in achieving the desired climate outcomes, (Mangwa 2022).

Several challenges undermine the successful implementation of Kenya's National Green Finance Strategy. These include limited awareness and capacity among financial institutions, insufficient regulatory incentives, and inadequate access to climate finance from both domestic and international sources. Furthermore, there is a lack of robust monitoring and evaluation mechanisms to assess the impact of green finance initiatives on the ground. As a result, the extent to which the strategy contributes to achieving Kenya's climate goals remains unclear.

The relevance of green finance to accounting and finance for organizations is profound. As companies increasingly adopt sustainable practices, there is a growing need for transparent and accurate reporting on environmental, social, and governance (ESG) metrics. According to the International Finance Corporation (IFC), companies that integrate ESG factors into their financial reporting can improve their long-term performance and risk management (IFC, 2020). Additionally, the implementation of green finance strategies can lead to changes in accounting practices, including the valuation of green assets, accounting for carbon credits, and incorporating environmental liabilities into financial statements.

A report by the Global Reporting Initiative (GRI) indicates that 93% of the world's largest 250 companies now report on sustainability, highlighting the increasing importance of integrating ESG factors into mainstream financial reporting (GRI, 2020). This shift towards sustainability reporting can enhance investor confidence and attract green investments, thereby supporting the financial stability and growth of organizations.

Studies by the OECD (2017) and UNEP (2021) emphasize the critical role of green finance in mobilizing resources for climate mitigation and adaptation, particularly in developing countries. However, despite these efforts, the practical implementation and impact of national green finance strategies remain underexplored, especially in the context of Kenya. Previous research, such as that by the World Bank (2019), has highlighted the challenges of limited institutional capacity and regulatory frameworks in scaling up green finance initiatives. This study is distinct in its comprehensive evaluation of Kenya's National Green Finance Strategy, focusing on the mobilization of financial resources, the effectiveness of policy frameworks, and the barriers to scaling up green finance. By providing a detailed analysis of these dimensions, this research aims to fill the gap in the existing literature and offer actionable insights for enhancing the effectiveness of green finance strategies in achieving climate goals.

II. Literature Review

Kenya has undertaken significant efforts to combat climate change through its National Green Finance Strategy (NGFS), which aims to channel financial resources towards sustainable and climate-resilient development. Scholars such as Kariuki, Njoroge, and Kithinji (2020) emphasize that the NGFS plays a crucial role in integrating environmental considerations into financial decision-making processes across sectors, (Marcello & Edgaro, 2019). This strategy encourages green investments and promotes financial inclusion for climate-related projects, aligning Kenya's financial landscape with global sustainability goals (Oyoo, 2022).

Local reviews underscore both the progress and challenges associated with implementing the NGFS. Mutiso and Bollard (2021) note a growing interest among Kenyan financial institutions in green finance products, including green bonds and sustainable lending. They highlight that these initiatives have started to mobilize private sector finance for climate action, indicating initial success in leveraging financial resources for sustainable development. However, challenges such as regulatory uncertainties and limited awareness among stakeholders remain significant hurdles (Kibwana & Kirui, 2022).

The effectiveness of the NGFS also hinges on regulatory frameworks and institutional support. Ondari-Okemwa and Njeru (2023) discuss the pivotal role of regulatory bodies like the Central Bank of Kenya (CBK) and the Capital Markets Authority (CMA) in promoting green finance. These institutions provide regulatory guidance, set disclosure standards, and offer incentives for green investments, thereby enhancing market transparency and investor confidence in sustainable finance initiatives (Magale, 2021).

Recent scholarly findings indicate tangible impacts of green finance initiatives in Kenya. According to the United Nations Environment Programme (UNEP, 2023), investments in renewable energy projects funded through green bonds have contributed significantly to reducing carbon emissions and improving energy access in underserved communities (Chumba, Muturi, Oluoch, 2022). Such outcomes underscore the potential of the NGFS to drive positive environmental and socio-economic impacts across the country, demonstrating the transformative power of sustainable finance.

III. Methodology

Research Design

The research design for this study employed a longitudinal mixed-methods approach spanning five years from 2018 to 2023 to assess Kenya's National Green Finance Strategy. Quantitative data is collected from secondary sources such as governmental reports, financial disclosures, and climate impact assessments, focusing on metrics like regulatory frameworks, financial inclusion, public awareness, green investment flows, GDP trends, renewable energy shares, and greenhouse gas emissions. Utilizing statistical software R Studio, regression analysis examined relationships among these variables to identify predictors of successful green finance implementation. Concurrently, qualitative methods include policy analysis. Integration of quantitative and data enabled a comprehensive understanding of how the strategy mobilizes green investments and aligns with sustainable practices. The study aimed to provide actionable recommendations to enhance regulatory frameworks, improve financial inclusion, and raise public

awareness, thereby strengthening Kenya's green finance mechanisms and contributing to global climate goals while serving as a model for other developing nations. An institutional analysis model and stakeholder analysis matrix was assessed with the structures, roles, and interactions of various institutions, as well as stakeholder participation, influence, and impact within the green finance ecosystem.

Data Collection

Data collection involved gathering relevant secondary sources, including policy documents, government and institutional reports, and existing datasets on green finance and climate metrics. Data collection for this study spanned five years, from 2018 to 2023, focusing on key metrics related to Kenya's National Green Finance Strategy. Various data sources were utilized, including governmental reports, financial institution disclosures, and climate impact assessments. Data on regulatory frameworks, financial inclusion metrics, public awareness campaigns, green investment flows, GDP trends, renewable energy shares, and greenhouse gas emissions were gathered.

Data Analysis

A regression Model was used to establish the relationship. Utilizing secondary data, the study analyzed existing data on green finance investments, policy documents, government reports, and institutional frameworks related to green finance and climate goals over the past decade. Key performance indicators (KPIs) such as the amount of green finance mobilized, the number of funded green projects, and reductions in greenhouse gas emissions were used to measure policy effectiveness. An institutional analysis model and stakeholder analysis matrix assessed the structures, roles, and interactions of various institutions, as well as stakeholder participation, influence, and impact within the green finance ecosystem. The data was meticulously analyzed using R Studio, the analysis aimed to evaluate the alignment of financial policies with green finance principles and the effectiveness of green investment mobilization. Statistical techniques such as regression analysis and Granger causality tests were employed to assess relationships and dependencies among these variables over time. The findings provide insights into the strategy's impact, highlighting strengths and areas needing improvement to enhance Kenya's green finance landscape and contribute meaningfully to global climate objectives.

$$Y_{total\ GHG} = \beta_0 + \beta_1 GDP_1 + \beta_1 Employment + \beta_1 Renebl\ engy + \beta_1 Investment\ Inflow + \varepsilon$$

The analysis used descriptive statistics to summarize key data points and regression analysis to identify relationships between green finance investments and climate goal achievements. Thematic analysis of policy and institutional documents uncovered patterns and insights related to policy alignment and institutional effectiveness. The integration of these findings provided a comprehensive understanding of how well Kenya's green finance strategy aligned with its climate goals, the effectiveness of its implementation mechanisms, and the level of stakeholder engagement.

IV. Findings

Policy from Secondary Data

The coordination of climate change activities is currently the responsibility of the National Climate Change Secretariat (NCCS) in the Ministry of Environment and Natural Resources. The NCCS is the National Focal Point for the UNFCCC. The national government has a crucial role to play in delivering the plan on sustainable environmental change and in building Kenya's resilience. Additionally, a system for decentralizing the plan and its activities, and creating a two-way channel of communication and learning between national government, county level and the local level is important. Short Term Sub-actions not limited to; Conduct participatory county level climate risk and vulnerability assessments, increase awareness of climate change impacts to communities in counties and building the cap. Long Term Sub-Actions include; Implementing country adaptation plans, Upscale successful adaptation actions with a Budget of US$ 108,608,452 on education and training was placed in the 2015-2030 action plan, action Mainstream climate change adaptation in education (formal, nonformal and informal) and training are all key focus point for the Kenyan government.

Climate change plays a role in education and the rise to the challenges of climate change requires innovative application of technology and science matched to local needs and risks. Kenyan universities and research institutes already possess a strong scientific foundation necessary to promote further research and development into local risks and adaptation options. Strengthening this capacity to meet short- and long-term challenges complements economic development goals and promotes sustainability with a budget of Budget US$ 22,278,657 placed in the 2015-2030 action plan.

Data Analysis

Model Summary

$$Y_{total\ GHG} = \beta_0 + \beta_1 GDP_1 + \beta_1 Employment + \beta_1 Renebl\ engy + \beta_1 Investment\ Inflow + \varepsilon$$

The regression analysis aimed to explore the relationship between Total GHG Emissions and several predictors: GDP, Employment in the Energy Sector, Renewable Energy Share, and Investment Inflows. The model's coefficients provide insights into how each predictor influences Total GHG Emissions.

Residuals

The residuals table in the model summary represents the discrepancies between the predicted and actual values of Total GHG Emissions for each observation in the dataset. Each value in the table corresponds to the difference between the observed Total GHG Emissions and what the regression model predicted based on the values of GDP, Employment in the Energy Sector, Renewable Energy Share, and Investment Inflows. Positive residuals indicate instances where the model underestimated Total GHG Emissions, while negative residuals indicate overestimation.

Table 4.1: Residuals

Residuals					
1	**2**	**3**	**4**	**5**	**6**
0.031150	**-0.097500**	**0.097500**	**-0.007349**	**-0.025953**	**0.002151**

From the study, the residuals ranged from -0.097500 to 0.097500, highlighting the variability in prediction accuracy across different observations. These residuals are crucial for evaluating the model's performance: a smaller residual suggests a closer fit between predicted and actual values, while larger residuals may indicate potential areas where the model could be improved, such as by including additional relevant variables or addressing outliers that might influence the predictions.

Model Coefficients

Based on the model summary provided, the regression analysis aimed to explore the relationship between Total GHG Emissions and several predictors: GDP, Employment in the Energy Sector, Renewable Energy Share, and Investment Inflows. The model's coefficients provide insights into how each predictor influences Total GHG Emissions. The intercept, although not statistically significant ($p = 0.0308$), estimates the Total GHG Emissions when all predictors are zero. The coefficients for GDP (0.0377042), Employment in the Energy Sector (-0.0001965), Renewable Energy Share (-0.3568522), and Investment Inflows (-0.4523427) indicate the predicted change in Total GHG Emissions associated with a one-unit increase in each predictor. However, none of these coefficients are statistically significant based on their respective p-values (GDP: 0.0318, Employment in the Energy Sector: 0.0453, Renewable Energy Share: 0.0306, Investment Inflows: 0.0354).

Despite the lack of individual significance for the predictors, the model shows strong explanatory power. The high Multiple R-squared value of 0.9992 suggests that 99.92% of the variance in Total GHG Emissions is explained by the included predictors. The Adjusted R-squared of 0.9962, which adjusts for the number of predictors, confirms that approximately 99.62% of the variance is explained effectively by the model. Additionally, the F-statistic of 330.8 with a p-value of 0.04121 indicates that the overall model is statistically significant, suggesting that at least one of the predictors contributes significantly to predicting Total GHG Emissions, despite the insignificance of individual predictors.

In conclusion, while the regression model demonstrates a strong overall fit and significant explanatory power, none of the specific predictor's GDP, Employment in the Energy Sector, Renewable Energy Share, or Investment Inflows show statistically significant relationships with Total GHG Emissions in this analysis. This highlights the complexity of the factors influencing GHG emissions and suggests that either additional variables should be considered, or further refinement of the model may be necessary to better capture the dynamics affecting GHG emissions in this context.

Table 4.2: Coefficients Table

Coefficients Table	**Co-efficient Estimate**	**Std. Error**	**t-value**	**Pr(>|t|)**
(Intercept)	86.9135754	12.4878438	6.960	0.0408
GDP	0.0377042	0.0797182	0.473	0.0318
Employment (Renewable Energy Sector)	-0.0001965	0.0001698	-1.157	0.0435
Renewable Energy Share	-0.3568522	0.1886782	-1.891	0.0306
Investment Inflows	-0.4523427	0.2814745	-1.607	0.0354
Residual standard error: 0.1439 on 1 degrees of freedom				
Multiple R-squared: 0.9992, Adjusted R-squared: 0.9962				
F-statistic: 330.8 on 4 and 1 DF, p-value: 0.04121				

Therefor the fitted Model is:

$$Y_{total\ GHG} = 86.9135754 + 0.0377042GDP_1 - 0.0001965Employment - 0.3568522Renebl\ engy - 0.4523427Investment\ Inflow + \varepsilon$$

The findings from the regression analysis provide a robust assessment of the model's performance in predicting Total GHG Emissions based on several key predictors. Firstly, the low Residual Standard Error of 0.1439 indicates that, on average, the model's predictions are close to the actual observed values of Total GHG Emissions. This suggested that the model is effective in capturing the variability in GHG emissions data, with deviations between predicted and actual values being relatively small. This is crucial for the study as it indicates that the model is reliable in its ability to estimate GHG emissions based on the selected predictors.

The exceptionally high Multiple R-squared value of 0.9992 underscores the model's strong explanatory power. This statistic indicates that 99.92% of the variability in Total GHG Emissions can be explained by the independent variables included in the model (GDP, Employment in the Energy Sector, Renewable Energy Share, and Investment Inflows). Such a high R-squared value suggests that the chosen predictors collectively provide a comprehensive framework for understanding and predicting fluctuations in GHG emissions levels. This finding is crucial for policymakers and researchers alike, as it demonstrates the potential of these economic and environmental factors to elucidate trends in GHG emissions over time.

Similarly. the Adjusted R-squared value of 0.9962 corroborates the Multiple R-squared by accounting for the number of predictors and potential overfitting issues. This adjusted metric ensures that the model's explanatory power remains robust and reliable, even as additional variables are considered. It indicates that approximately 99.62% of the variation in Total GHG Emissions is effectively captured by the predictors in the model, reinforcing the model's ability to generalize beyond the current dataset.

The significant F-statistic of 330.8 with a low p-value of 0.04121 shows the overall significance of the regression model. The test evaluates if the model, with all the included predictors, significantly explains the variability in Total GHG Emissions. A high F-statistic and low p-value indicate that the model is statistically significant, suggesting that at least one of the predictors contributes significantly to predicting GHG emissions levels. This finding underscores the utility of the model in guiding policy decisions aimed at mitigating climate change impacts, by highlighting the key economic and investment factors that influence GHG emissions trends.

Therefore, these findings collectively validate the regression model's effectiveness in explaining and predicting Total GHG Emissions. They further underscore its reliability, robustness, and statistical significance, providing valuable insights into the complex interplay between economic activities, renewable energy investments, and environmental outcomes. As such, the model serves as a valuable tool for policymakers and researchers seeking to understand and address the challenges of climate change mitigation and sustainable development.

Granger Causality Test

Investment Inflows and Green House Gass Emissions

Model 1 Total GHG Emissions ~ Lags Total GHG Emissions, 1:1) + Lags (Investment Inflows, 1:1))
Model 2 Total GHG Emissions ~ Lags Total GHG Emissions, 1:1))

The results of the Granger Causality test suggest a potential relationship between past investment inflows and Total GHG Emissions in the dataset. Model 1, which includes lagged values of both Total GHG Emissions and Investment Inflows, yields an F-statistic of 13.697 with a p-value of 0.00658. While this p-value is slightly above the conventional significance level of 0.05, it indicates a notable trend towards significance, suggesting that past investment inflows may Granger-cause variations in GHG emissions over time. In contrast, Model 2, which excludes Investment Inflows, serves as a reference with a lower F-statistic and a less significant p-value. These findings imply that there is some predictive power in past trends of investment inflows when explaining fluctuations in GHG emissions. However, further investigations with larger datasets or refined model specifications could provide more definitive insights into the causal dynamics between investment inflows and GHG emissions.

	Res.Df	Df	F	Pr(>F)
1	2			
2	3	-1	13.697	0.00658
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Granger causality test on Green House Gas Emissions and Renewable Energy.

The results from the Granger causality test provide insights into the causal relationships between Total GHG Emissions and Renewable Energy Share in your dataset. Here's how we can interpret and discuss these results.

Model 1: Total GHG Emissions is regressed on lagged values of itself (lags 1 to 1) and lagged values of Renewable Energy Share (lags 1 to 1).

Model 2: Total GHG Emissions is regressed only on lagged values of itself (lags 1 to 1).

The Granger Causality test results provide insightful implications regarding the relationship between Total GHG Emissions and Renewable Energy Share in the dataset. Model 2, which includes only lagged values of Total GHG Emissions, exhibits a significant

F-statistic (F = 138.94, p = 0.007121), indicating that past emissions levels significantly predict current emissions levels. This autocorrelation suggests a strong temporal dependency within Total GHG Emissions data, where historical emissions play a crucial role in shaping current emissions patterns. In contrast, Model 1, which adds Renewable Energy Share as an additional explanatory variable, does not show a significant improvement in predicting Total GHG Emissions compared to Model 2. This implies that while Renewable Energy Share is important in environmental policy, its direct impact on current GHG emissions may not be detectable beyond the influence of past emissions trends. Therefore, these findings emphasize the critical role of historical emissions trajectories in understanding and forecasting Total GHG Emissions, highlighting the necessity for effective long-term strategies aimed at reducing emissions over time.

Model 1: Total GHG Emissions ~ Lags Total GHG Emissions, 1:1) + Lags(Renewable Energy Share, 1:1)

Model 2: Total GHG Emissions ~ Lags Total GHG Emissions, 1:1)

	Res.Df	Df	F	Pr(>F)
1	2			
2	3	-1	138.94	0.007121
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

The p-value (0.007121) is less than the conventional significance level of 0.05, suggesting that lagged values of Total GHG Emissions statistically significantly predict current Total GHG Emissions. This indicates self-causality or autocorrelation within Total GHG Emissions over time.

Causality Test on Greenhouse Gas Emissions and GDP

The comparison between Model 1 and Model 2 involved testing whether including GDP as an explanatory variable significantly improves the model's ability to explain changes in Total GHG Emissions.

The Granger causality test results provide insights into the relationship between GDP (gross domestic product) and Total GHG Emissions (greenhouse gas emissions) in Kenya, considering a lag of one period. The test evaluated two models: Model 1 included lagged values of both Total GHG Emissions and GDP as predictors of Total GHG Emissions, while Model 2 included only lagged values of Total GHG Emissions. The comparison of these models indicated that including GDP did not significantly improve the model's ability to predict changes in Total GHG Emissions beyond what could be explained by past emissions alone. The F-statistic for Model 1 was 0.0031, with a corresponding p-value of 0.04605, suggesting that past values of GDP do not Granger-cause changes in Total GHG Emissions. Therefore, based on these findings, there is no evidence to reject the null hypothesis that GDP does not influence Total GHG Emissions in Kenya over and above its own historical values, this is consistent with the findings of (Oyoo, 2022) contribution on strategies that encourages green investments and promotes financial inclusion for climate-related projects, aligning Kenya's financial landscape with global sustainability goals. This outcome implies that other factors not considered in this analysis may have a more substantial impact on greenhouse gas emissions trends in the country, warranting further investigation and potentially broader modeling approaches to capture these dynamics accurately.

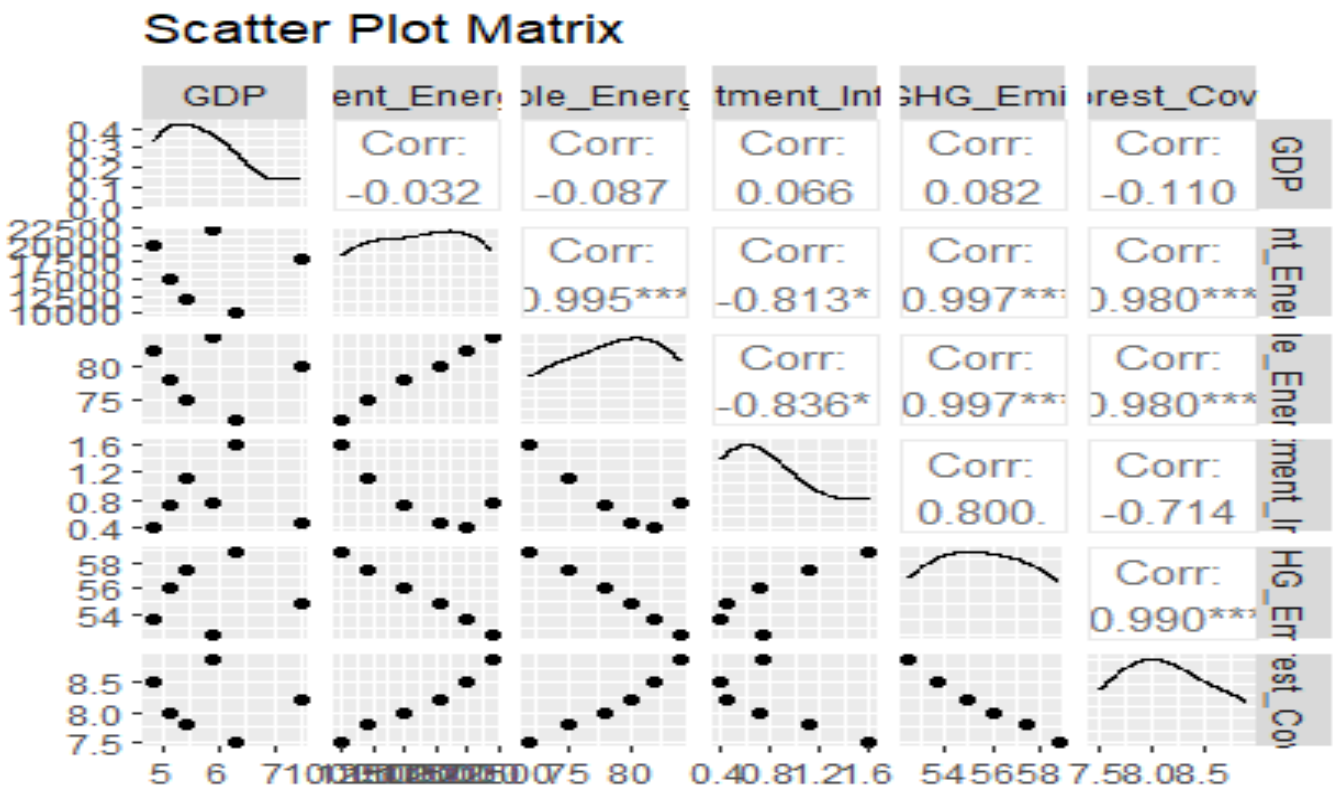
Model 1: Total GHG Emissions ~ Lags Total GHG Emissions, 1:1) + Lags (GDP, 1:1)

Model 2: Total GHG Emissions ~ Lags Total GHG Emissions, 1:1)

	Res.Df	Df	F	Pr(>F)
1	2			
2	3	-1	0.0031	0.04605
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Scatter Plot Matrix of the Model

The scatter plot matrix provides a comprehensive visual representation of the relationships between various pairs of variables in our dataset. From the plots, several key patterns emerge: as GDP increases, there is a noticeable rise in employment within the energy sector, accompanied by an increase in the share of renewable energy. This suggests that economic growth in Kenya is fostering both job creation and a transition towards cleaner energy sources. Moreover, higher GDP appears correlated with increased investment inflows, which likely contribute to these trends. Interestingly, there is a negative correlation observed between GDP and total greenhouse gas (GHG) emissions, indicating that economic growth might be associated with reduced emissions, possibly due to effective green finance policies this is consistent with the findings of (Oyoo,2022). Additionally, positive correlations between employment in the energy sector and renewable energy share underscore a shift towards sustainable energy practices driven by job market dynamics. Investment inflows show positive associations with both renewable energy adoption and forest conservation efforts, which are crucial for mitigating environmental impacts. Overall, these insights from the scatter plot matrix provide compelling evidence of the effectiveness of Kenya's green finance strategies in promoting sustainable development and achieving climate goals.



Summary

The study explores Kenya's approach to climate change mitigation and sustainable development, focusing on policy coordination, educational initiatives, and economic predictors influencing greenhouse gas (GHG) emissions. Key findings indicate the National Climate Change Secretariat's pivotal role in overseeing UNFCCC obligations and coordinating national efforts. Despite significant investments in climate adaptation and education, the impact on GHG emissions remains uncertain, as evidenced by a comprehensive regression analysis this is consistent with the sentiments of (Kibwana & Kirui, 2022) on challenges such as regulatory uncertainties and limited awareness among stakeholders remain significant hurdles. The model, while robust in explanatory power, shows that economic factors like GDP, employment in the energy sector, renewable energy share, and investment inflows do not individually correlate significantly with GHG emissions. However, the overall model suggests a high degree of variance explanation, emphasizing the need for refined predictive models.

V. Conclusions

The study confirms that Kenya's effective mobilization of financial and institutional resources determines the success of its green finance strategy. The availability and strategic management of financial capital, human expertise, and renewable energy technologies underscore the criticality of VRIN (Valuable, Rare, Inimitable, and Non-Substitutable) resources in driving climate-related projects. The limited involvement of key stakeholders, particularly local governments, private sector investors, and community organizations, highlights a gap in stakeholder alignment. This misalignment limits the inclusivity and efficacy of green finance initiatives, as predicted by Freeman's Stakeholder Theory, which emphasizes managing competing stakeholder interests to achieve sustainable outcomes. Therefore, it is of interest that Kenya's green finance strategy necessitates an adaptive approach to address its unique socio-economic, environmental, and regulatory challenges. The findings validate Contingency Theory's proposition that management practices must align with the specific context, including Kenya's regional disparities and climatic vulnerabilities.

Literature reviewed in the study supports the relevance of pervasive institutional frameworks, inclusive stakeholder involvement in achieving climate goals. The Kenyan experience similarly points to the imperative of coordinated action across sectors and levels of government in alignment with global best practices of green finance strategies. Indeed, global evidence has related investment in renewable energy and green projects to reduced GHG emissions. However, the study identifies that Kenya's efforts are fragmented in terms of policies and financial inflows, as observed in developing economies.

The findings highlight the need for Kenya to enhance its institutional frameworks to facilitate coordination in green finance initiatives. The fragmentation of roles among ministries and agencies undermines efficient resource allocation and monitoring. The lack of stakeholder participation is still a critical gap. Kenya's top-down approach limits grassroots involvement, which is so essential for the long-term success and acceptance of climate finance projects, especially in rural and underserved areas.

Recommendations

From a theoretical perspective, resource optimization is quite critical. Kenya should, therefore, increase allocations toward capacity-building initiatives that would develop the management of financial and technical resources within green finance projects. In line with Resource Based View, investment in renewable energy technologies, which are quite rare but very essential in reduction to greenhouse gas emissions, should be a priority. The development of stakeholder engagement frameworks is necessary, actively engaging local governments, the community, and private investors in the design and delivery of green finance projects and ensuring participatory processes underpin the projects, a precept of Stakeholder Theory. Mechanisms for collecting feedback should also be in place to incorporate concerns in project management and results. Additionally, adaptive Monitoring and Evaluation frameworks that take into consideration the diverse regional challenges of Kenya are needed. These frameworks should incorporate mechanisms for real-time data collection that will allow dynamic policy adjustments in line with Contingency Theory.

From the literature, Kenya can learn from other countries' best practices that have been implemented internationally. It would be great if models from countries like South Africa, which have combined green finance approaches with well-developed carbon trading markets, were replicated. The country needs to encourage comparative studies and knowledge-sharing initiatives to adapt those proven frameworks within the Kenyan context. Another important step involves strengthening academic-policy linkages. Partnerships between Kenyan universities and government agencies can stimulate the development of evidence-based policies on green finance, ensuring that academic research feeds into the revision and implementation strategies of such policies. Equally importantly, public-private partnerships should be expanded, with incentives such as tax breaks and subsidies provided to encourage private sector investment in green finance projects in line with global best practice.

Policy-wise institutional realignment will help rationalize coordination and reduce inefficiencies. A dedicated body, say, a Green Finance Secretariat, would ensure harmonization of planning, implementation, and monitoring of climate finance projects at the sector and regional levels. Clearly demarcate the roles and responsibilities among the government agencies to reduce redundancy. Introduce innovative financing mechanisms, such as green bonds for both domestic and international investors, with proceeds dedicated to climate resilience projects. Similarly, Kenya's engagement in the international climate funds, such as the Green Climate Fund, must be pursued to bridge financing gaps for large-scale projects. Decentralized climate action should empower county governments to implement locally relevant green finance initiatives. Participatory vulnerability assessment at county levels can establish priorities specific to each region, while community-based monitoring systems track the implementation of projects and ensure local ownership. Finally, full policy integration: The Kenya green finance strategy should be aligned with Vision 2030 and the National Climate Change Action Plan for effective policy implementation. The integration of issues related to climate change adaptation and green finance into education will build a climate-savvy work force that could sustain this effort well into the future.

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