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Climate Governance and Sustainable Development: Rethinking Policy Responses for a Resilient Future

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ABSTRACT

This research focused on the studies regarding the role of climate governance, policy effectiveness, and institutional resilience in sustainable development. A quantitative research technique was chosen, which involved a structured questionnaire administered to 350 respondents from different institutions (NGOs, private sector, academic institutions, and government institutions) active in the climate and sustainability sectors, drawn using simple random sampling. The data were analyzed descriptively, with reliability, Pearson correlation, and multiple regression in SPSS Version 27. The reliability test showed good internal consistency in this study, ranging from 0.876 to 0.918 Cronbach's α . The descriptive statistics showed positive perceptions of all the variables studied, ranging from 4.09 to 4.26. The research found that all factors of climate governance, policy effectiveness, institutional resilience, as well sustainable development, showed positive correlations with each other (ranging from 0.653 to 0.781; $p < 0.01$), as obtained through correlation analysis. Multiple regression analysis revealed that climate governance ($\beta = 0.352$, $p < 0.001$), policy effectiveness ($\beta = 0.291$, $p < 0.001$), and institutional resilience ($\beta = 0.334$, $p < 0.001$) are significant determinants of sustainable development. The regression model explained 74.3% of the variance in sustainable development ($R^2 = 0.743$; $F = 334.58$; $p < 0.001$). The study attributes high governance quality and good governance performance, through policy enforcement and institutional strengthening, to high sustainable development outcomes. It concludes that these three play significant roles in supporting sustainable development. The results are relevant to policymakers who are interested in strengthening Climate Governance mechanisms for a sustainable future.

Keywords: Climate Governance, Institutional Resilience, Policy Effectiveness, Sustainable Development, Sustainability, Transparency.

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Introduction

One of the most prominent global impairment that affects environmental sustainability, economic growth and society is climate change. However, with the influx of global warming and extreme climatic phenomena as well as loss in biodiversity and increase in Greenhouse Gases (GHGs) the global governments are put to a great test to develop solid climate policies. The ecological alterations and changes affected food security, water resources, public health, infrastructure, economic output and activities in developed and developing nations. With the increasing climate change threat, policymakers started to understand the need for a single environmental law to address the multi-levelness of the climate change issues. In the area of strategies of sustainable development long-term policy planning and institutional coordination has become an indispensable tool (Gupta, 2016; Biermann et al., 2012).

The definition of climate governance was: 'the institutional arrangements, laws and legal documents, policy tools and instruments, and cooperation mechanisms to 'govern' actions for climate change mitigation and adaptation. Various governance mechanisms were created by national governments, international organizations, the private sector and civil society organizations to address issues of accountability, transparency and evidence-based decision making. The good governance practices led to strengthening of environmental policies, technological innovations and social inclusion and thus, economic development. More countries have been able to include climate in the national plans, where environmental protection has not conflicted with sustainable economic changes and human development goals (Biermann, 2017; Jordan, 2009).

Governments were prompted to take action to combat climate change in their wider developmental agenda following the UN Sustainable Development Goals (SDGs) and Paris Climate Agreement, which were adopted in 2015. Governments were collaborating on resilient supply of renewable energy and sustainable infrastructure, adaptation of agriculture to climate change, green financing, and ecosystem conservation as a way to be resilient to climate

risk. The work done has helped achieve balanced development to date, with carbon emissions reduction, and has reinforced the competitiveness of existing and future economic activities and quality of life. International cooperation and the transfer of knowledge, financial resources, and technologies have reinforced the implementation of climate governance frameworks in different regions (Biermann et al., 2022; Hickmann et al., 2024).

Challenges arose for many countries, linked to the lack of regional and district-level policy dialogue, inconsistent implementation gaps and institutional constraints, as well as financial constraints and inequality in countries' adaptation capacities in the ongoing evolution of climate policymaking. All of these impediments contributed to the reluctance in forming policies on climate and action on sustainable development goals. The increase in the occurrence of climate-related disasters led to the need to re-imagine current approaches to governance and seek more inclusive, adaptive, and resilient policy responses. The focus of the study was on climate governance and sustainable development, as well as integrated governance policies, institutional capacity building, and a basis of evidence for climate governance (Gupta, 2016; Biermann et al., 2012; Hickmann et al., 2024).

Background of the Study

Today, climate issues are more of a development agenda, as climate issues have gone from the environmental realm and spread to national planning, economic policy and international cooperation. The scientific proof is convincing, and consistent with the consequences of climate change on the natural world, agricultural productivity, public health, energy security, and socioeconomic security. Eventually, ideas of a government responding to crises and managing the environment were supplanted by the emergence of an approach to governance based on the concept of proaction, which involves both mitigation, adaptation, emergency risk reduction and sustainable resources. Given the complexity of climate related challenges, attention on several elements that define institutional effectiveness, institutional coherence, and multi-stakeholder governance was growing also as part of this evolving trend (Biermann et al., 2012; Gupta,

2016).

Climate governance was not confined to rules of compliance; it encompassed a form of participation at policy levels as well as intergovernmental, private sector and community levels. The government has taken various measures to enhance climate resilience, such as introducing carbon reduction initiatives, incentives for renewable energy, sustainable urban planning approaches, and environmental monitoring systems. International agreements supported institutional strengthening and the creation and development of institutional governance frameworks that can support effective response to environmental changes. These governance reforms underlined the need to strike the balance between environmental protection and economic growth and social justice (Biermann 2017; Jordan 2009).

Climate targets started to be consolidated in national and regional policies and became part of sustainable development. Because of the successful integration of climate goals in national and regional policies, climate goals had become indispensable for sustainable development. Expansion and growth of the economy resulted in reduced resources and ecological degradation, and increased climate vulnerability. Infrastructure which has built resilience, investments in renewable energy, restored ecosystems and sustainable production systems brought environmental and economic benefits. Inclusive growth and natural resource management through the lens of green innovation, technology and institutional partnerships were also incorporated into pathways to climate resilient development (Pathways to climate resilient development Biermann et al., 2022, Hickmann et al., 2024).

The growing risk complexity then overtook the concepts of traditional governance, and there no longer seemed to be a need to review them. Increasing effectiveness of adapting policies in a changing environment through adaptive governance frameworks focused on adaptive management, learning and building of capacity, sharing and participation of decision makers, and using evidence for decision making. Responses to climate change were strengthened by improving the institutional resilience and by enhancing the coordination between the public institutions and

other actors (private institutions, researchers, and local communities). This study had this lens and sought to map out the elements of a climate change resilience and sustainable development future - the effectiveness of policies, the resilience of institutions, and their capacity to govern (Biermann et al., 2012; Gupta, 2016; Nurunnabi, 2026).

Research Objectives

1. To explore the impact of Climate Governance on Sustainable Development.
2. To measure the impact of the effectiveness of policies on sustainable development.
3. To study the role of institutional resilience for sustainable development.
4. To measure the contribution of climate governance, policy effectiveness, and institutional resilience to a resilient and sustainable future.

Research Questions

- Q1.** How did climate governance impact sustainable development?
- Q2.** What is the impact of the effectiveness of policies on the sustainable development?
- Q3.** How did institutional resiliency support sustainable development?
- Q4.** What impact did all of these factors have on fostering a climate-resilient and climate-sustainable future?

Significance of the Study

It added to the knowledge base on climate governance and sustainable development by providing a thorough understanding of the effect of governance mechanisms on sustainable development outcomes, policies, and institutional resilience. Results were beneficial for learning on strengthening climate governance and implementing policy for policy makers, environmental agencies, IOs, and development practitioners. Maritime Policy, institutionalized governance and transparency in decision making processes were also highlighted as necessary conditions for overcoming climate issues and contributing to economic development and social welfare and environmental sustainability. The recommendations helped not only governments design evidence-based climate policies aimed at increased capacity to adapt and be sustainable but

also others. The research offered academic insights and knowledge to scholars and students, establishing a groundwork for the future study of climate governance, climate resilience, and climate sustainability in a national and international framework.

Literature Review

Climate Governance and Sustainable Development

Climate governance has become a value system inclusive enough to assist in directing collective action towards climate change and sustainable development activities. Laws and policies, institutional measures, financial instruments and partnerships that can help governments and stakeholders to reduce GHG emissions and/or improve their capacity for adaptation. It promoted policy coherence between the environmental, economic and social components and integrated climate as an element of national and regional development planning through good climate governance. Systems of good governance with transparent decision making processes, high institutional accountability and stakeholder involvement showed more sustainable and resilient development outcomes as compared to systems with more fragmented governance (Bäckstrand et al., 2022; Newig and Fritsch, 2023; IPCC, 2023).

As climate change had an impact on all aspects of sustainable development, the link between climate governance and sustainable development became the topic of significant research interest. Among the other elements, reducing environmental harm came second to economic stability, social equity, and institutional effectiveness, all of which played their part in developing sustainability. In response, governments recognized that they need to approach governance in the much wider sphere of climate change not only as an environmental issue but country-wide, in concert through all sectors of society including energy, agriculture, transportation, urban planning and industrial sectors. This integration promoted resource efficiency, reduced environmental degradation, encouraged the use of renewable energy, and increased society's resilience to disasters caused by climate change (United Nations, 2023; OECD, 2023; Sachs et al., 2024).

Multi-level relationships among governments, other entities like international organizations, private companies, academic partners, and civil society organizations were also mentioned as a way of collaborating in the field of Climate Governance today. The key areas of collaborative governance that contributed to the success of policies were: Sharing of knowledge, Technological innovation, Mobilization of finances and Institutional learning. A country's ability to adaptively manage environmental conditions was more closely related with its capacity to respond to these changes—both economically and socially—and to achieve sustainable economic growth and social development. As the governance quality became one of the most serious conditions in the face of growing climate risks and linkages growing in complexity, researchers came to that conclusion (Jordan et al., 2023; Biermann et al., 2024; UNEP 2024).

Policy Interventions to Increase Effectiveness and Resilience

Effective policies are vital for effective climate governance: they provide the foundation for strategic objectives that translate into concrete environmental and developmental impacts. With the success of climate policies, clear frameworks of implementation, realistic performance indicators, and transparent monitoring systems emerged, which made the policy accountability consistent. The trend of governments adopting policies and plans for climate change has accelerated, and the incorporation of reduction goals, climate investments in renewable energies, ecosystem protection and disaster risk management has gained grounds. Policy solutions were successfully integrated to boost the environment, social wellbeing and competitiveness (IEA, 2023; IPCC, 2023; World Bank, 2024).

Together with the effectiveness of the policies, institutional resilience worked to build the resilience of public institutions to respond to an environment of uncertainty, socioeconomic pressures and climate risks—resilient institutions in the implementation of the policies, which were flexible, adaptable and continuously learning. Governments can coordinate climate action across sectors, mobilise finance for climate action, enact

environmental legislation and regulations and engage with stakeholders with institutional capacity building. Institutional resilience also contributed significantly to evidence-based decision making, as evidenced through building in scientific knowledge and technological innovation, and incorporating local experiences into the climate governance process (OECD, 2023; United Nations Development Programme, 2024; Gupta et al., 2023).

The effectiveness of policies and their contribution to the resilience of institutions to achieve sustainable development goals has grown in significance. Innovative institutions were necessary to develop effective policies and a viable policy framework to identify strategies for resilient institutions. In many cases, policy implementation was poor, partly because of poor administrative efficiency, financial constraints, and insufficient capacity to seamlessly coordinate between the different grassroots public agencies and divergent governance frameworks. More effectiveness and institutional resilience were needed to increase adaptive governance and long-term climate sustainability, in line with other research indicating that improving these elements is vital for a successful transition to more sustainable, low-carbon food systems (Biermann et al., 2024; Bäckstrand et al., 2022; Newig & Fritsch, 2023).

Adaptive Responses to Policy for a Resilient Future

One noteworthy feature was the additional consideration of adaptive policy reactions, as a result of the increasing uncertainties posed by the climate change to environmental planning and sustainable development. Existing governance mechanisms are more likely to follow traditional ways of doing things and would take time to adapt to new challenges due to climate change. Policy review, institutional learning, involving stakeholders, and flexible decision-making processes were key features of adaptive governance that enabled governments to respond to the changing environmental realities by adapting their policies. The dynamic approach promoted policy flexibility, and boosted both climate outcomes and capacity to respond to climate change, making policies more effective and strong in addressing complex climate issues

(Folke et al., 2023; Jordan et al., 2023; IPCC, 2023).

Mainstreaming adaptive climate governance and resilient development became more likely through technological developments. Digital Technologies, GIS, AI, Climate Modelling, Remote Sensing, and Environmental monitoring systems were key elements in enhancing the policy formulating and carrying-out process. These technologies were applied to better predict the climate, to improve resource management, to facilitate disaster preparedness, to support environmental monitoring, and to give accurate data to the policymakers for their decision-making process. Governance systems and capacities/abilities have been enhanced and innovative processes incorporated for anticipating climate risks and acting on time (Vinuesa et al. 2023; IEA, 2023; UNEP, 2024).

Policy processes were increasingly inclusive and collaborative, and an understanding of the interconnection between environmental protection, economic development, and social justice was developing in climate change governance. Governments adopted strategies to integrate various levels of engagement of local communities, academia, public and private sectors, and international partners into the decision-making process for addressing climate change. Participation in governance boosted trust in government, leading to shared government accountability and legitimacy of policy in relation to climate action. Governance tools had to be transparent, accountable, innovative, and sustainable development-friendly systems. In the midst of the shifting landscape of climate risks, adaptive governance arrangements played a key role in supporting the creation of resilient societies for sustainable development and the protection of environmental resources for future generations (United Nations, 2023; Sachs et al., 2024; Biermann et al., 2024; UNEP, 2024).

Research Methodology

Research Design

A quantitative research methodology was used to investigate the relationship between climate governance and SD. The cross-sectional survey design was chosen as it has the main advantage of being able to obtain information at one point in time. The quantitative approach enabled the

numerical measurement of the interdependence of climate governance and the effectiveness of climate policies, institutional climate resilience, and sustainable development. This design improved objectivity in the analyses and reduced the researcher's interpretational bias. It further allowed for a suitable model to apply statistical analysis to test the relationships proposed.

Population of the Study

A blend of policy makers, environmental professionals, scientists, researchers, academics, and practitioners in sustainable development and public policy and administration for climate governance and sustainable development. These individuals represented government agencies, environmental protection agencies, universities or research institutions and non-governmental agencies or organizations. Through their learning and experiences, they gained insights into the implementation of climate governance and policy implementation. The data gathered provided informed opinions on environmental governance and sustainable development within the selected population. The range of respondents also helped enhance the credibility and quality of the findings.

Sampling Technique and Sample Size

A purposive sampling technique was used to select 350 respondents in the study. This was deemed proper considering the knowledge and experience baseline of the respondents was relevant to the topic of climate governance and sustainable practices. Purposive sampling allowed the researcher to capture the information that is key from the individuals involved directly with environmental planning and development of policy and management of institutions. The sample was adequate for descriptive and inferential statistical analyses. Also, it helped ensure the results of the study were more reliable and increased the overall representativeness of the study.

Data Collection Instrument

A structured questionnaire was used to collect primary data. This questionnaire consisted of two parts. Demographic information (gender, age, education, experience, and organizational affiliation) was collected in part 1. The second section in this consisted of messages on climate governance, policy effectiveness, institutions'

resilience and sustainable development. They were all assessed from 1 (Strongly Disagree) to 5 (Strongly Agree).

Data Collection Procedure

The survey was sent out via online surveys, email, and printed materials at professional meetings and academic events. The participants were given a short description of the aim and goals of the study before filling out the questionnaire. At this stage the participation was still voluntary, and respondents filled out the questionnaire in their free time. Completed questionnaires were closely scrutinized to detect missing, suspicious, or incomplete answers. Only correct responses were used for statistical analysis. This helped ensure the quality and accuracy of the collected data.

Measurement of Variables

Three independent variables – climate governance, policy effectiveness, and institutional resilience – and one dependent variable – sustainable development – were measured in the study. Climate governance assessed institutional coordination, transparency, accountability, and participation of various stakeholders in decision-making processes related to the climate. Policy effectiveness measured the implementation, monitoring, and enforcement of climate-related policies. Institutional resilience was measured as an organization's ability to react to environmental challenges and policy changes. The environmental, economic, and social sustainability outcomes were measured. Multiple indicators were computed for each construct to ensure measurement reliability.

Data Analysis Techniques

The data collected were analyzed with the aid of the Statistical Package for the Social Sciences (SPSS) version 27. Data analysis was done using descriptive statistics, including frequencies, percentages, mean and standard deviations, in order to summarize the respondents characteristic and the identified variables of the study. Pearson correlation analysis was conducted to determine the nature and strength of the relationships between the variables. The impact of climate governance, policy effectiveness, and institutional resilience was examined using multiple regression analysis. The measurement scales were assessed in terms of reliability using Cronbach's Alpha.

Statistically significant results were regarded at a 5% significance level ($p < 0.05$) for objective interpretation of the results.

Results and Analysis

Data was analyzed by the Statistical Package for

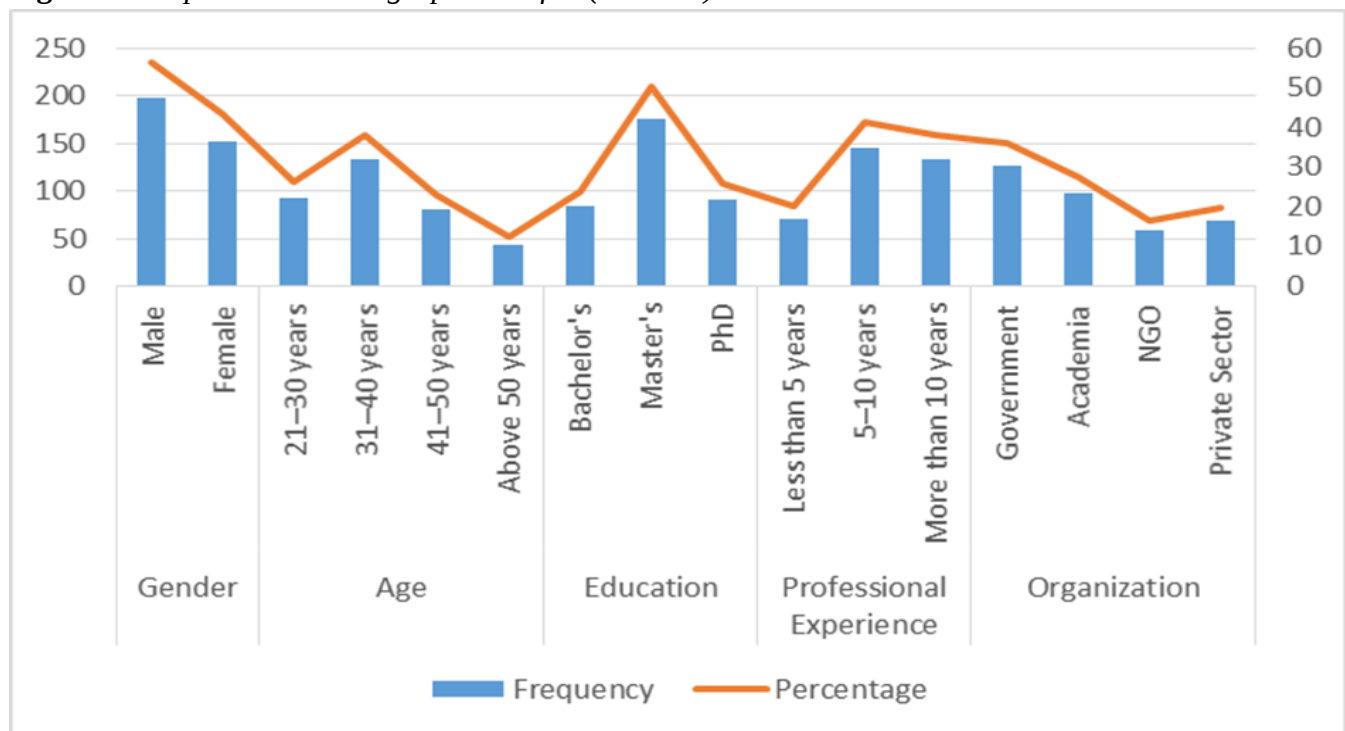
the Social Sciences (SPSS) Version 27. Descriptive and inferential statistics were used to summarise the results, and explore how these dimensions link to sustainable development, resilience of institutions and effectiveness of policies.

Table 1: *Respondents' Demographic Profile (N = 350)*

Variable	Category	Frequency	Percentage (%)
Gender	Male	198	56.6
	Female	152	43.4
Age	21–30 years	92	26.3
	31–40 years	134	38.3
	41–50 years	81	23.1
	Above 50 years	43	12.3
Education	Bachelor's	84	24.0
	Master's	176	50.3
	PhD	90	25.7
Professional Experience	Less than 5 years	71	20.3
	5–10 years	145	41.4
	More than 10 years	134	38.3
Organization	Government	126	36.0
	Academia	97	27.7
	NGO	58	16.6
	Private Sector	69	19.7

Males were 56.6% of the respondents, and the females were 43.4% of the respondents, as shown in Table 1. The majority of respondents were in the age group 31–40 (38.3%), followed by the 21–30 age group (26.3%). 50.3% of the sample had a master's degree, resulting in a highly educated sample. In addition, 41.4% reported 5–10 years of professional experience, and government

organizations were the largest group of respondents (36.0%). The characteristics indicated that the respondents have a sufficient education level and experience to give their opinions on climate governance and sustainable development.

Figure 1: Respondents' Demographic Profile (N = 350)**Reliability Analysis (Cronbach's Alpha)**

To check the internal consistency of the measurement scales of the questionnaire,

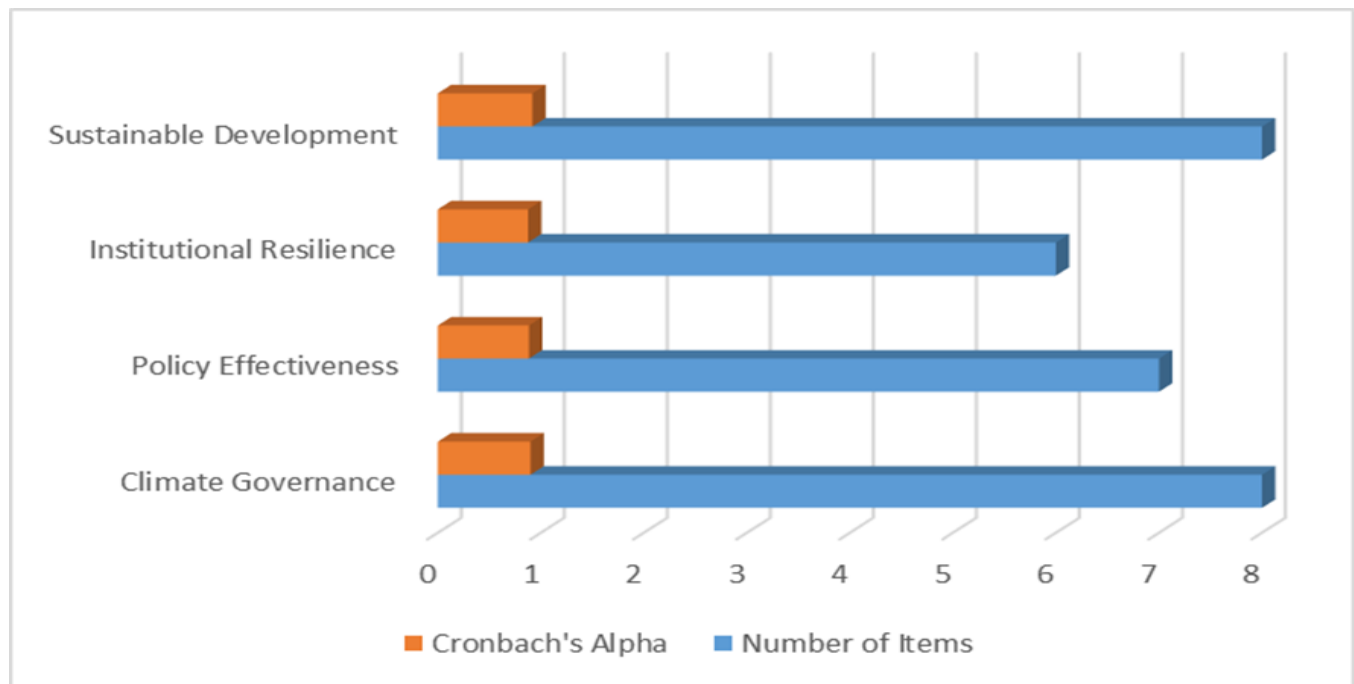
reliability analysis was conducted. Cronbach's Alpha coefficient was used to investigate if all the items that tapped the same construct consistently tapped the construct itself.

Table 2: Reliability Analysis

Variable	Number of Items	Cronbach's Alpha
Climate Governance	8	0.901
Policy Effectiveness	7	0.884
Institutional Resilience	6	0.876
Sustainable Development	8	0.918

From the results of the Cronbach's alpha seen in Table 4.2, all the study variables demonstrated high Cronbach's alpha values greater than 0.80. The reliability coefficients of the instruments are the highest, with Climate Governance at $\alpha = 0.901$, followed by Sustainable Development ($\alpha =$

0.918), Policy Effectiveness ($\alpha = 0.884$), and Institutional Resilience ($\alpha = 0.876$). This shows very high internal consistency among the items included in the questionnaire, and the reliability of the measurement scales was acceptable for further statistical analysis.

Figure 2. Reliability Analysis**Descriptive Statistics**

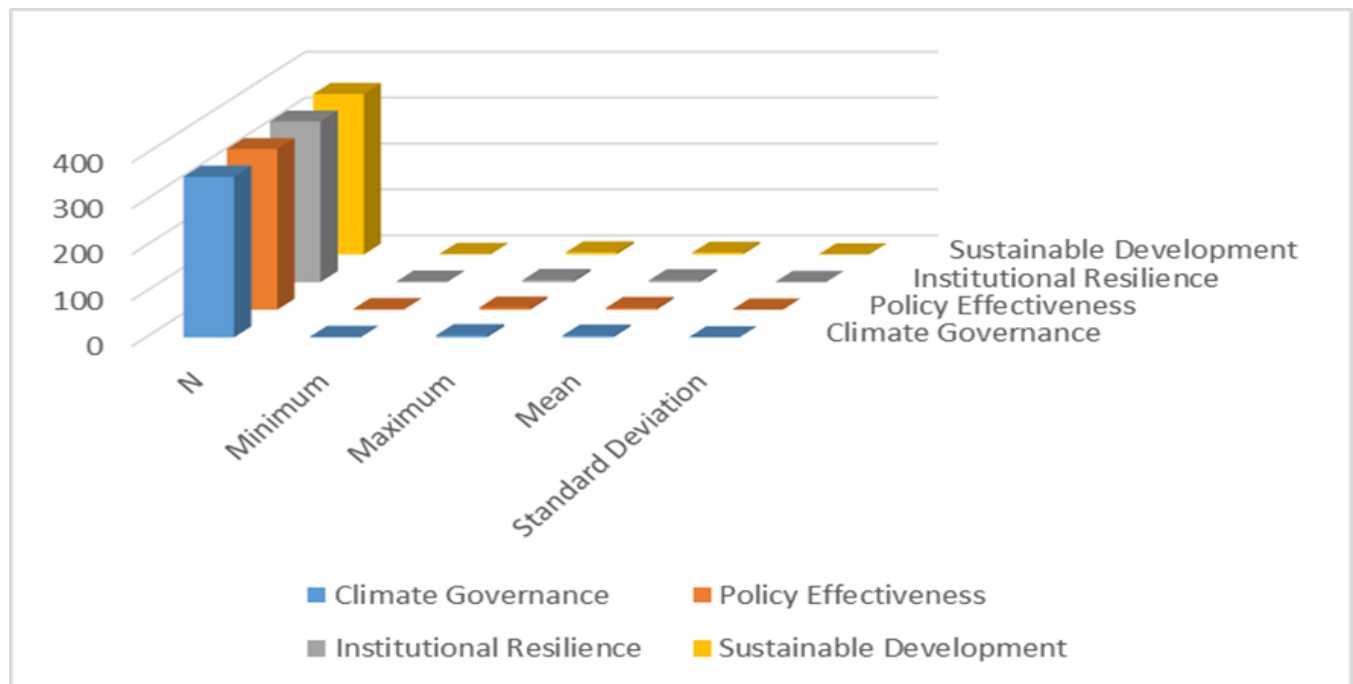
Descriptive statistics were computed to

summarize the central tendency and variability of the study variables.

Table 3: Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Standard Deviation
Climate Governance	350	1.45	5.00	4.17	0.58
Policy Effectiveness	350	1.62	5.00	4.09	0.63
Institutional Resilience	350	1.51	5.00	4.13	0.61
Sustainable Development	350	1.70	5.00	4.26	0.56

The descriptive statistics of the variables of this study are given in Table 4.3. The highest mean score ($M = 4.26$) was achieved by SD: Sustainable Development, followed by Climate Governance ($M = 4.17$), Institutional Resilience ($M = 4.13$), and Policy Effectiveness ($M = 4.09$). All the standard deviations of these constructs in the study were relatively low ranging from 0.56 to 0.63 implying that the respondents always responded to the constructs being studied. Descriptive statistics indicate positive views on climate governance practices and efforts to address sustainable development.

Figure 3: Descriptive Statistics**Correlation Analysis**

Pearson correlation analysis was conducted to

examine the strength and direction of the relationships among the study variables.

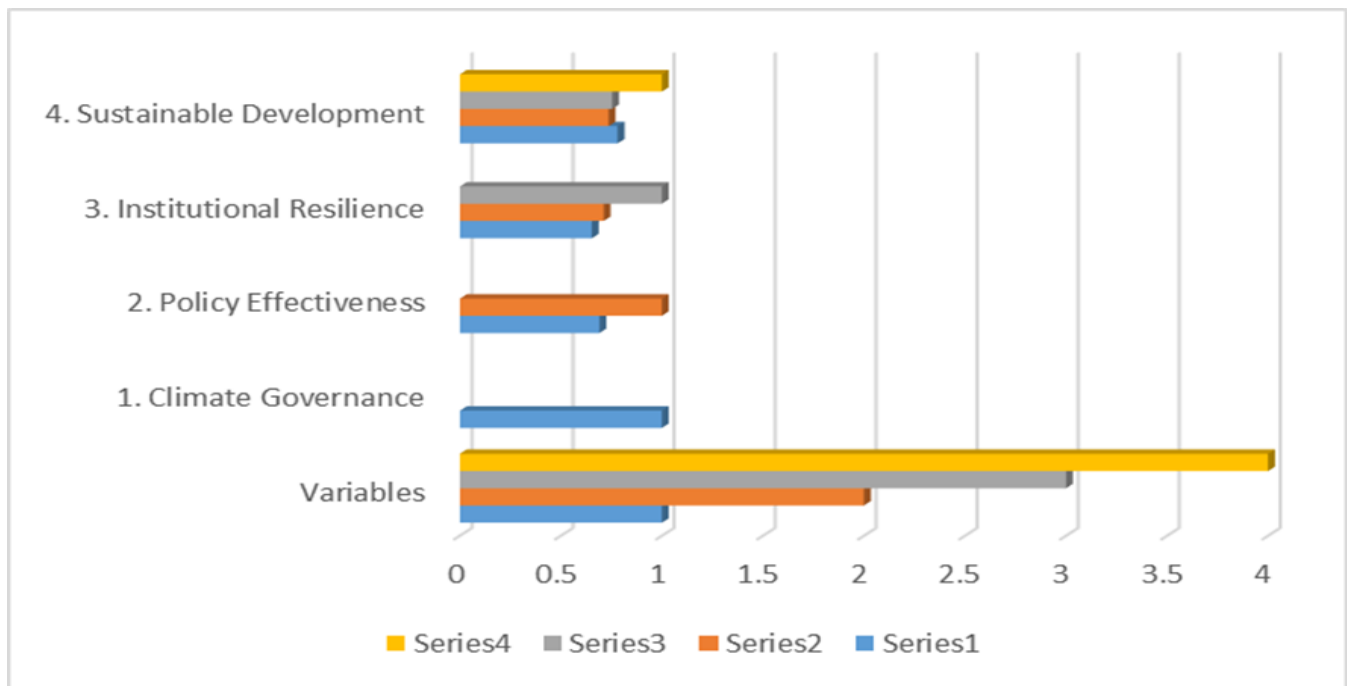
Table 4: Pearson Correlation Matrix

Variables	1	2	3	4
1. Climate Governance	1			
2. Policy Effectiveness	0.691	1		
3. Institutional Resilience	0.653	0.712	1	
4. Sustainable Development	0.781	0.736	0.754	1

Note: $p < 0.01$

Table 4 indicates that the variables tested in the study have a positive and significant correlation. The SD were found to be correlated with Climate Governance ($r = 0.781$, $p < 0.01$). Sustainable Development had positive, significant associations with Policy Effectiveness ($r = 0.736$, $p < 0.01$) and a strong positive association with

Institutional Resilience ($r = 0.754$, $p < 0.01$). Analysed statistically, these data have revealed positive correlation between improving the quality of governance, the implementation of policies and the resilience of institutions, on the one hand, and high sustainable development indicators on the other hand.

Figure 4: Pearson Correlation Matrix**Multiple Regression Analysis**

Multiple regression analysis was performed to

examine the combined influence of climate governance, policy effectiveness, and institutional resilience on sustainable development.

Table 5: Multiple Regression Analysis

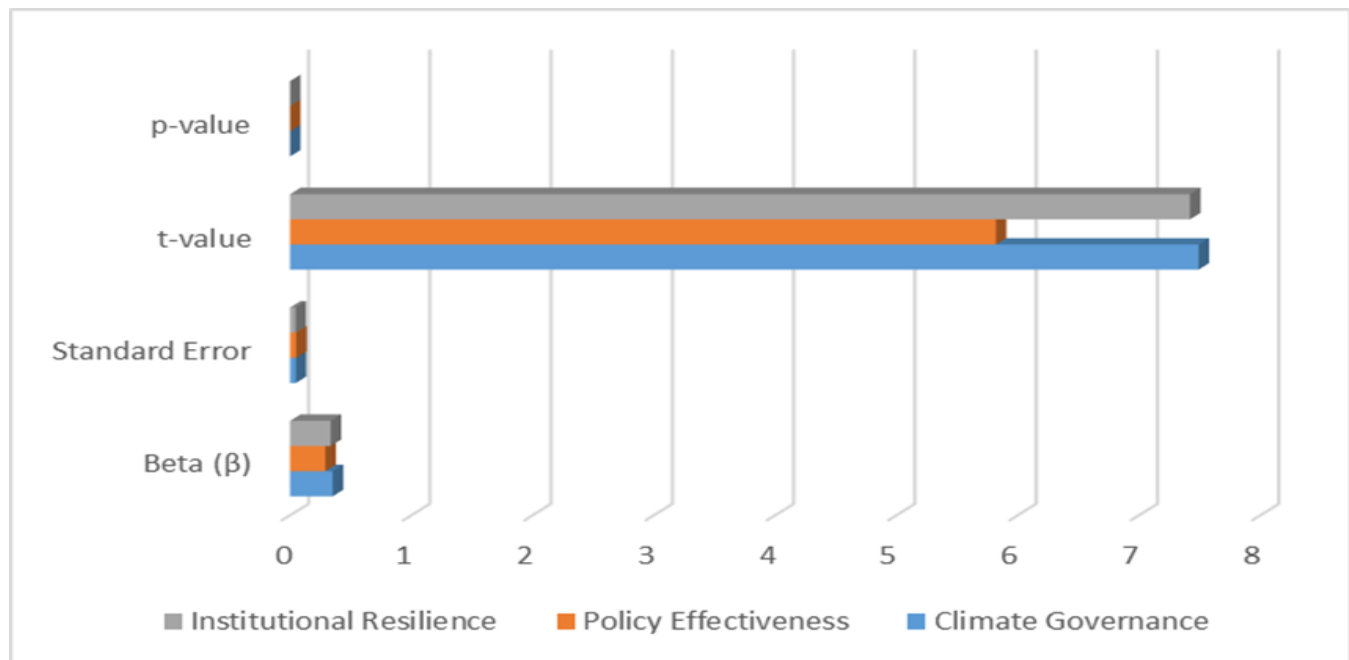
Predictor Variable	Beta (β)	Standard Error	t-value	p-value
Climate Governance	0.352	0.047	7.49	0.000
Policy Effectiveness	0.291	0.050	5.82	0.000
Institutional Resilience	0.334	0.045	7.42	0.000

Model Summary

R	R ²	Adjusted R ²	F-value	Sig.
0.862	0.743	0.741	334.58	0.000

The Table 5 below displays the results from the Multiple Regression Analysis on the role of Climate Governance, Policy Effectiveness and Institutional Resilience in driving Sustainable Development. The regression model was statistically significant ($F = 334.58$, $p < 0.001$) and explained 74.3% of the variance in Sustainable Development ($R^2 = 0.743$). Climate Governance

emerged as the strongest predictor ($\beta = 0.352$, $t = 7.49$, $p < 0.001$), followed by Institutional Resilience ($\beta = 0.334$, $t = 7.42$, $p < 0.001$) and Policy Effectiveness ($\beta = 0.291$, $t = 5.82$, $p < 0.001$). The results of this study suggest the independent variables have a positive and significant effect on Sustainable Development, and are consistent with the theoretical framework hypothesized in this study.

Figure 5: Multiple Regression Analysis

Discussion

The study showed that sustainable development has helped a lot as the governance moves towards sustainable development, so in that sense the governance plays a very important role in the climate change problems with sustainable development in the environment, economy, and society. There was strong evidence of the positive relationship existing between climate governance and sustainable development, identifying that supportive institutional arrangements and policy coordination, involving all stakeholders, enhanced the capacity of the governments to deliver long-term sustainable development. The results of this research align with the earlier study by Biermann et al. (2022) and Sachs et al. (2024), who stressed the need to have good governance and enhance resilience towards climate change and sustainable development. The results of this research correspond with the previously cited studies of Biermann et al. (2022) and Sachs et al. (2024), who highlighted the importance of good governance for improving resilience towards climate change and fulfilling sustainable development goals. The integration of policies across sectors, enhanced institutional accountability, and increased support for action on climate adaptation and mitigation are possible through good governance mechanisms.

In addition, the findings show a positive relationship between policy effectiveness and

sustainable development, emphasizing the importance of implementing a well-designed and well-implemented climate policy for sustainable development. Ready policy reporting documents, monitoring systems, and regulatory procedures ensure the secure implementation of policies and support investments in renewable energy opportunities, sustainable infrastructure, and adaptation to climate change. The results are in line with previous studies that have found the successful and effective implementation of policies led to an increase in the governance of the environment, which also supported the development towards sustainable development through the strengthening of inter-institutional cooperation between two or more of the same type of institutions, as well as the incorporation of various institutions (OECD, 2023; World Bank, 2024; IPCC, 2023). Governments need to encourage the lightening of the further improvements in policy effectiveness in the light of evidence, regular policy review, and increased administrative capacity.

The condition of resilient public institutions was also relevant to indicators of SD – resilient public institutions can effectively respond to environmental uncertainty and future changes in climate conditions. An institutional arrangement for policy continuity during periods of crisis and long-term environmental sustainability that involves built-in adaptive capacity, institutional flexibility, and effective coordination mechanisms

can be achieved at various institutional levels. The findings are consistent with the current research, demonstrating that IR can greatly assist the adaptive governance process by stimulating innovation, resource mobilization, and differently aligned governance levels (UN Development Programme, 2024; Folke et al., 2021; Gupta et al., 2023). Building institutional resilience is thus critical for governments' capacity to handle the increased complexity of climate risks.

The correlation analysis confirmed the positive relationships between climate governance, climate policy effectiveness, climate-institutional resilience, and sustainable development: they are complementary rather than independent. The regression analyses revealed that all the three independent variables were significant predictors of SD; out of them, climate governance had the greatest influence among the independent variables. The results highlight that sustainable development is not possible without holistic governance systems with strong institutions, policies, and regular participation and cooperation among stakeholders. Jordan et al. (2023), Newig and Fritsch (2023), and Biermann et al. (2022) have identified that Climate Change policies are more effective and lead to greater climate resilience in the long term when bolstered by integrated governance mechanisms.

The findings corroborate the theoretical concept that sustainable development is fundamentally dependent on the inclusion of climate governance underpinned by the sound policies and timely and resilient institutions. The quality of governance goes beyond the environmental regulation to include institutional capacity, public participation, accountability, and adaptive governance. Worsening climate risks mean governance tools must pay more attention to reforms that ensure cross-sector coordination, innovation, development of climate technologies, and transparency in governance. The existing and emerging issues identified relate to current research around the world on adaptive governance, which is considered a fundamental prerequisite to facilitate the achievement of SDGs and to build resilience to future environmental issues (Hickmann et al., 2024; UNEP, 2024; United Nations et al, 2023).

Conclusion

Their focus was on the effects of climate governance on sustainable development, the effectiveness of climate action policy, and climate action resilience. All three showed a positive and significant impact on sustainable development, which underscored the very high dependency of SD on the sustainable governance systems established to cope with climate change and sustain economic growth, climate protection and social wellbeing. The strongest predictors with clear governance are those related to climate governance, that is, coordinated, transparent and inclusive approaches to governance, as well as engaging stakeholders and holding institutions to account to achieve sustainability targets. The development of well-defined policies bolstered the effective implementation of climate initiatives, monitoring frameworks, and strategic planning that enabled climate-related policy interventions, and institutional resilience helped organisations handle climate-related uncertainties and govern effectively in the future. The integrated governance models build on this finding by combining community-based elements of strong institutions, effective policies and adaptive capacity, and collaborative decision-making, designed to ensure long-term environmental and socio-economic resilience of the study models.

Recommendations

The findings indicate that special attention should be paid to the governance of climate action, as more efficient intergovernmental policy coordination, transparency, and policy dialogue and engagement at all governance scales at the policy-making and policy-implementation levels are needed, accompanied by a more collaborative approach by policymakers. Institutional capacity building, infrastructure development, resilience, adaptation of renewable technologies, and mainstreaming climate considerations in the country's development plans will need more investment. Monitoring and evaluation mechanisms that are effective and feed into good governance management should be put in place to facilitate the implementation of the policies and continually improve the level of governance based on the provided evidence. It is also important for public entities to enable partnerships with universities, private entities, and civil society

organizations in innovation and transfer of knowledge, as well as to raise the awareness of the necessity of climate action. The need is for advanced technologies and modeling (such as Artificial Intelligence, Geographic Information Systems, Remote Sensing, and Environmental Monitoring Systems) to support climate forecasting, as well as resource management and adaptive governance to drive climate development goals.

Future Directions

There is a need to conduct further research on other possible elements that could influence sustainable development, including climate finance, environmental leadership, green innovation, engagement of the public, digital governance, and international climate cooperation. Analyses comparing the operation of

the various countries/regions could also offer a more regional account of how the governance systems would work within different institutional and social contexts. Governors use longitudinal research to monitor governance and sustainable development over a period of time. To further investigate the interrelationship of the governance variables, in future studies researchers could apply advanced techniques like SEMs, Mediation Analysis, and Moderation Analysis. Mixed-methods research using quantitative, qualitative, and other methods might generate more understanding of efforts to implement policies, adjust institutions, and involve policy stakeholders. Investigations of new digital technologies can offer additional context on how digital technologies contribute to more robust governance on climate change and resilient and sustainable development.

Conflict of Interest

The authors showed no conflict of interest.

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