International Journal of SDG's Prospects and Breakthroughs, Volume 3, Issue 3, 2025
ISSN-3107-5320

Integrating Climate Change Mitigation and Adaptation Strategies into SDG Frameworks for Resilient Global Development

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Abstract: This paper seeks to discuss the effects of incorporating climate change mitigation and adaptation plans in the context of Sustainable Development Goal (SDG) frameworks in promoting resilient global development. It aims to find major synergies and tradeoffs between climate action and chosen SDGs, considering the joint effectiveness of mitigation-adaptation plans, and considering their implications for resilience and policy coherence. It was decided to use a mixed-method, systems-based approach, which involved the combination of qualitative literature and policy analysis and quantitative methods of modeling. Peer-reviewed studies, international policy frameworks, and SDG monitoring reports were used as the sources of secondary data. The findings were presented in a conceptual Climate SDG integration framework, as well as interaction network mapping, cross-impact, and composite indexes, which consist of an Integrated Climate Performance Score (ICPS) (0.84) and a multidimensional Resilience Index (RI) 13 of socio-economic, environmental, and institutional dimensions. Combinations of mitigation and adaptation plans had a higher ICPS (0.78) compared to either mitigation (0.62) or adaptation (0.62). The results of resilience were also significantly higher when using integrated frameworks, as the composite RI of the fragmented policies (0.48) was compared to that of integrated approaches (climate and SDG, 0.78), which was also stronger by 30%. The highest gain was observed in institutional resilience, which went up by 0.44 to 0.75. The scores of policy coherence were also higher in integrated frameworks (0.76) than in sector-specific policies (0.51), and positively and significantly correlated with resilience outcomes ($r = 0.73$). The results validate the fact that integrated climate-SDG planning is an important approach to supplementing resiliency, policy coherence, and sustainable development results, and that coordinated mitigation-adaptation plans integrated into SDG frameworks are necessary.

Keywords: Adaptation; Climate change; Mitigation; Resilience; Sustainable Development Goals.

(Submitted: June 09, 2025; Revised: July 18, 2025; Accepted: August 04, 2025; Published: September 25, 2025)

I. Introduction

One of the most important threats to sustainable development is climate change, which has weakened the progress in the economic, social, and environmental aspects. The increase in global temperatures, extreme weather occurrences, rise in sea levels, and loss of biodiversity are increasingly having an impact on food security, human health, water supply, infrastructure, and livelihoods, especially in the risky and low-income areas. To that end, the 2030 Agenda of Sustainable Development set by the United Nations has put in place 17 Sustainable Development Goals (SDGs) to enhance inclusive growth, environmental conservation, and social justice (Tarek & Abood, 2014).

Although SDG 13 (Climate Action) directly deals with climate change, the aspects of mitigation and adaptation are and will inevitably be related to the several other SDGs, such as poverty alleviation (SDG 1), zero hunger (SDG 2), clean water (SDG 6), affordable and clean energy (SDG 7), sustainable cities (SDG 11), and ecosystem protection (SDGs 14 and 15). Climate policies are, however, usually undertaken in complete isolation, thus creating fragmented policies, inefficiencies, and unintended tradeoffs. Having climate mitigation and adaptation as part and parcel of the overarching SDG system is thus critical to the establishment of long-term resilience and coherent, cross-sectoral developmental pathways (Semeraro et al., 2020).

This research aims to address the major issue of investigating the interdependencies between climate change mitigation and adaptation strategies and the Sustainable Development Goals (SDGs), and the subsequent impact of interactions on resilient development outcomes (Larijani, 2016). The paper will aim

to establish major synergies and possible tradeoffs that arise when climate actions are not done in isolation, but as part of a broader set of SDGs. It also seeks to establish a conceptual framework that would integrate the processes of climate mitigation and adaptation into SDG-based planning of development in a systematic manner. In addition, the research assesses the extent to which integrated climate–SDG strategies can enhance resilience, equity, and sustainability at both global and regional scales (Serra et al., 2022). Finally, the study provides policy-relevant insights to support coherent and coordinated climate and development decision-making processes (Nejad & Fard, 2019).

Although the concept of the climate-SDG nexus is becoming more and more recognized, current literature has a number of significant gaps. Most of the literature still considers climate mitigation and climate adaptation as two distinct policy areas without providing much analysis of the interconnected impact of climate change in integrated SDG frameworks (Gan et al., 2023). Besides, the existing SDG evaluations tend to concentrate on the indicators of the goals, neglecting the interaction of goals and cross-goal climate feedback. Also, there is no strong empirical and conceptual guidance on how integrated climate strategies could be realized in those spheres and at those governance tiers. Additionally, few frameworks adequately evaluate resilience outcomes resulting from climate–SDG integration, particularly in developing and climate-vulnerable regions. Addressing these gaps is critical to advancing holistic, systems-based approaches to sustainable development (Majlingova & Kádár, 2024).

The hypothesis that guides this research is that the incorporation of climate change mitigation and adaptation processes into SDG frameworks leads to more robust synergies in development in comparison with climate efforts alone (Chandel et al., 2025). It also assumes that climate strategies that are cross-sectorally aligned among SDGs considerably increase the socio-ecological resilience and long-term sustainability. The study also hypothesizes that the better the development results and adaptive capacity of countries are, the more integrated climate and SDG planning frameworks they have, as compared to countries that use a sector-specific or fragmented approach towards planning.

This study makes the following key contributions

- Offers a combined conceptual framework between climate mitigation, adaptation, and SDG targets to promote resilient development pathways.
- Create knowledge on climate-SDG synergies and tradeoffs based on a systems approach.
- Emphasizes the contribution of integrated governance, policy coherence, and institutional coordination towards climate-resilient SDGs.
- Provides actionable insights for policymakers, planners, and international development agencies to mainstream climate action across SDG implementation.
- Advances the research on sustainable development by highlighting resilience as the common effect of climate-SDG integration.

This article has six main sections, which are geared towards exploring how climate change mitigation strategies and adaptation can be integrated into the Sustainable Development Goal (SDG) to ascertain resilient global development. Section I, in which the context and purpose of the research, hypothesis, and critical contributions are provided, says that there is a need to integrate climate and SDG consistently. Section II is the review of the existing literature to synthesize the existing studies on climate action, SDGs, resilience, governance, and policy coherence to identify the main gaps. Section III includes the materials and methods that describe the mixed methods research design, conceptual framework, data sources, methods of analysis, and approach to resilience assessment. Section IV presents findings, such as climate-SDG interaction mapping, synergy and tradeoff analysis, integrated climate performance evaluation, resilience outcomes, and governance coherence findings. Section V is about the implications of the results, which underline the benefits of the integrated mitigation-adaptation approaches and their contribution to

resilience. Lastly, Section VI is a conclusion to the study that summarizes the main findings, policy implications, and future research directions (Ilmar et al.,2024).

II. Literature Survey

The connection between climate change and sustainable development is well-researched, and it is agreed that mitigation and adaptation to climate change are part and parcel of the attainment of the Sustainable Development Goals (SDGs). (Chandel et al., 2024) claim that climate change represents a systemic limitation to economic growth, social equity, and environmental sustainability, whereas (Türkeş, 2024) argues that sustainable development pathways are necessary to achieve long-term adaptation and effective mitigation of climate change. These views underscore the fact that climate action cannot be limited to SDG 13, but it must be incorporated throughout the entire SDG in order to make the system more resilient.

There is also a substantial literature on the value of the unification of climate adaptation, disaster risk reduction (DRR), and sustainable development. According to (Yamazaki-Honda, 2022) and (Cubie & Natoli, 2021), policy coherence among climate adaptation, DRR, and SDGs is central to disaster resilience, and disjointed governance compromises implementation. (Majlingova & Kadar, 2024) also report that adaptive capacity building, rather than the diminishing of risks, is more appropriate to promote sustainable development in Latin America and the Caribbean because of the mismatch between the Sendai Framework and SDGs.

The challenges of governance and institutional coordination are also cited as the major problems of operationalizing climate-SDG integration. (Swaris et al., 2024) show that misalignment between climate adaptation policies, DRR strategies, and SDG implementation reduces resilience in Sri Lanka's built environment. According to (Husainy et al., 2024), one of the obstacles to climate action-SDGs integration is fragmented responsibilities and poor institutional coordination. (Mthembu & Nhamo, 2022) emphasizes that SDG 13 needs to be aligned with the development agenda of South Africa, and this means that the global agenda should be operationalized into effective adaptation policies through strong institutions (Owusu-Sekyere et al., 2024).

A number of studies recommend sectoral and regional structures to institutionalize climate action in the implementation of SDGs. Karani et al. (2023) provide a framework to consider climate change as one of the pillars of African Blue Economies and explain that mitigation, adaptation, and resilience can be promoted by means of sustainable management of marine resources. Naswar et al. (2024) demonstrate the role of the SDG-aligned policies in enhancing adaptive resilience in the communities located along the coast, and Cremin et al., (2023) match the Global Delta Risk Index with SDGs and the Sendai Framework to make resilient socio-ecological planning in the river deltas possible (Lucatello & Alcántara-Ayala, 2023).

Specific adjustment measures and technological advancement are also the enabling factors of climate-resilient SDG development. As demonstrated by (Fuldauer et al., 2022), it is good to emphasize the use of SDG interdependencies to make decisions regarding adaptation measures and ensure that development gains are preserved and the risks of climate change are reduced. (Gan et al., 2023) present this fact, stating that a renewable energy system is core to the meeting of several SDGs, particularly those relating to access to energy and climate action. The technologies that are emerging, such as artificial intelligence demonstrated by (Al-Raeei, 2024), also increase the possibilities of improving the climate resilience in the context of SDGs 11 and 13 by enhancing the ability to plan urban development, assess risks, and respond more effectively.

Although these developments have been made, the literature also finds major tradeoffs between SDGs. According to (Cohen et al., 2025), the tendency to promote economic growth, food security, and urban development can compromise climate and equity goals if the considerations of climate are not integrated adequately. (Assarkhaniki et al., 2023) state the importance of introducing resilience assessment into SDG evaluation frameworks to deal with tradeoffs and enhance adaptive capacity. According to (Flood et al.,

2021), it is impossible to have resilient future goals without systems-based approaches that would consider the interplay of the climate risks, development pathways, and the vulnerabilities in society.

In short, although existing research has demonstrated that there is a strong tendency to integrate climate mitigation and adaptation in SDGs, a huge portion of the literature is highly disjointed. This promotes the importance of holistic, integrated frameworks that must focus on climate action, sustainable development, and resilience in order to develop resilient global development pathways.

III. Materials and Methods

Research Design

This study employs a mixed-methods research design, integrating both qualitative and quantitative approaches to analyze how climate change mitigation and adaptation strategies can be integrated within Sustainable Development Goals (SDGs) frameworks to enhance global resilience. The design has systems-oriented thinking in order to investigate the intricate interdependencies among climate change activities, sustainable development, and resilience. This approach involves the synthesis of available literature, reviews of policies, and modelling to reveal synergies, tradeoffs, and feedback loops between the SDGs to guarantee conceptual rigor and policy relevance. There is also the application of multi-level frameworks and transdisciplinary views to bring about a comprehensive view of the world's development and climate resilience.

Conceptual Framework Development

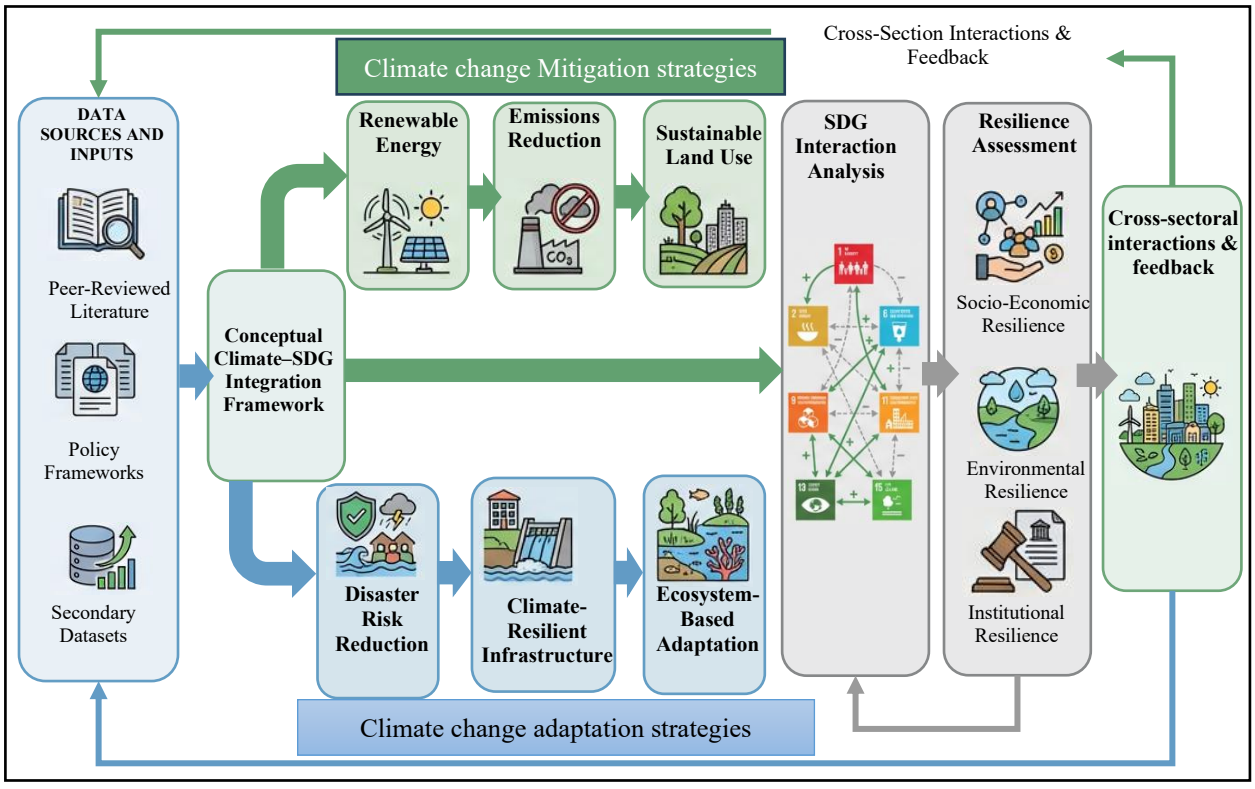

Figure 1: Integrated Methodological Framework for Climate–SDG Resilience Analysis

The figure 1. demonstrates the research approach to incorporate climate change mitigation and adaptation insights in the SDG framework by illustrating how data and literature can be integrated into the conceptual framework, the interaction between mitigation and adaptation, SDG synergies and tradeoffs,

and evaluating the results of resilience, and this can be summarized by policy and governance implications for resilient global development.

The figure shows the research philosophy to be applied to bring the climate change mitigation/adaptation strategies into the Sustainable Development Goal framework. It depicts the flow from data and literature inputs through conceptual framework development, analysis of mitigation–adaptation interactions, assessment of SDG synergies and tradeoffs, and evaluation of resilience outcomes, culminating in policy and governance insights for resilient global development.

Data Sources and Selection

The research is based on secondary sources at the world, regional, and national levels, which guarantees the presence of coverage on sectors and geographies. The most important sources will be peer-reviewed journal articles about climate change, SDGs, and resilience, international organizations (such as the United Nations and the World Bank) policy reports, and SDG monitoring databases. The other sources are national adaptation plans (NAPs), international climate frameworks such as the Paris agreement and the Sendai Framework on Disaster Risk Reduction, and progress reports on SDG implementation, so that the study encompasses a wide range of opinions and global realities.

Analytical Approach

The paper adopts an integrative approach to analytic research, which involves a combination of qualitative content analysis and quantitative research methods to address the climate-SDG nexus. The qualitative content analysis is utilized to determine the most important themes in the literature and policy documents, including mitigation strategies, adaptation measures, governance models, and resilience-enhancing policies. This thematic analysis gives a profound insight into the way climate actions conform and influence the SDGs.

One of the most important aspects of the analysis is the application of a cross-impact matrix, which examines how the 17 SDGs interact. This matrix determines the positive synergies (when climate actions promote the development of several SDGs), negative tradeoffs (when some actions cannot reach other SDGs), and neutral interactions (when there is no critical impact on other SDGs). Also, conceptual models are developed to simulate the impact of various mitigation and adaptation strategies on SDG outcomes in terms of a systems-interaction approach. The modeling can be useful in determining the best ways to build resilience and reduce negative tradeoffs among development targets.

Integration of Mitigation and Adaptation within SDGs

This research paper discusses the role of climate change mitigation strategies and climate change adaptation strategies separately and combined, and how these strategies contribute to the goal of SDG achievement. These mitigation measures, like renewable energy use and transitions to low-carbon, are considered together with adaptation strategies like climate-resilient infrastructure and the restoration of ecosystems. The paper examines how such strategies can produce a co-benefit, including the promotion of poverty reduction, health, sustainable cities, and responsible consumption. It also looks at possible tradeoffs that can occur, such as in the case that the renewable energy projects can be a source of conflict against the conservation of local ecosystems. This is intended to find avenues by which the integration of climate strategies can be used to improve socio-ecological resilience with minimal unwanted adverse effects on development goals.

Resilience Assessment

A composite framework is used to evaluate resilience based on the socio-economic, environmental, and institutional aspects. The SDG targets are associated with indicators of adaptive capacity, exposure reduction, and systemic flexibility to assess the outcomes of resiliency. This evaluation does not just look at the systems of development in terms of resilience to climate stress; instead, it focuses on the capacity of the development systems to maintain the progress. This model directly connects resilience to the performance of sustainable development in which systems are taken as the capacity to absorb, adapt, and transform to climate shocks and remain able to sustain long-term development objectives.

Policy and Governance Analysis

A major point of this study is the governance and policy coherence analysis. This section examines the alignment of the national and regional climate action plans, adaptation strategies, and SDG implementation mechanisms. It looks at institutional forms and policy papers so as to isolate the enabling and blocking factors to successful integration. The governance analysis reveals the significance of coordinated governance, cross-sectoral planning, and participatory decision-making processes in actualising integrated climate frameworks as action policies. The research also finds the best practice to assure policy coherence across sectors, which is that multi-level governance and robust institutional frameworks are essential in the translation of global climate and SDG targets into localized, meaningful actions.

Validation and Synthesis

In order to reach the strength of the designed system of integration, the paper employs a triangulation approach and cross-platform interpretation of results of different data sources, such as literature and policy documents, SDG monitoring reports, etc. This will provide consistency and reliability of the findings. The conclusion synthesis will incorporate the conceptualization, analytical, and policy evaluation, and ratify the proposed framework, providing a holistic view of how climate mitigation and adaptation can effectively be incorporated in SDG frameworks. The synthesis defines the best practices, shared difficulties, and lessons to be used by other states in their implementation of climate-resilient SDGs, and offers solutions that policymakers and development practitioners can apply in different global settings.

IV. Results

Climate–SDG Interaction Mapping Results

The combined methodological approach showed that there are close interrelations among climate change mitigation, adaptation policies, and various SDGs. The cross-SDG analysis of the selected SDGs (SDGs 1, 2, 6, 7, 9, 11, 13, and 15) revealed that climate mitigation strategies were characterized by a set of positive interactions with energy, infrastructure, and urban sustainability objectives, whereas adaptation strategies were associated with a higher number of connections with poverty reduction, water security, and ecosystem preservation. Figure 2 shows the intensity of interaction of SDGs, with SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities), and SDG 13 (Climate Action) in the middle of the integrated network.

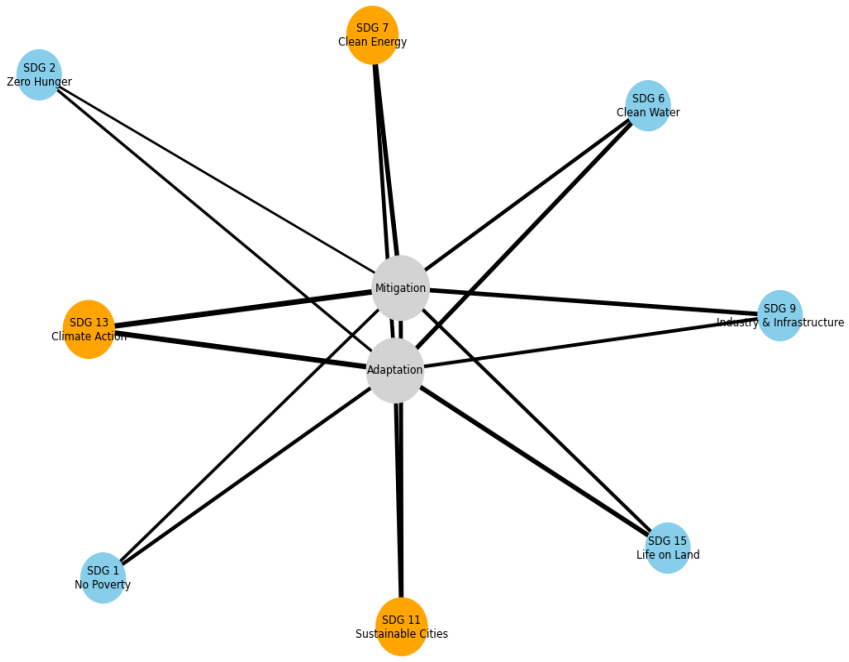

Figure 2: Climate–SDG Interaction Network Diagram showing interaction strengths between mitigation, adaptation, and SDGs

Figure 2 depicts the interaction network between climate change mitigation and adaptation strategies and selected SDGs. Nodes are SDGs and climate activities, and weighted links indicate the degree and direction of interactions, with the fatter connections showing stronger synergies.

The interaction strength between climate actions and SDGs was quantified using a normalized interaction index I_{ij}, defined as:

$$I_{ij} = \frac{S_{ij} - T_{ij}}{S_{ij} + T_{ij}} \qquad (1)$$

In equation (1), S_{ij} represents synergy scores, and T_{ij} represents tradeoff scores between climate strategy iii and SDG j. Values closer to +1 indicate strong synergies, while values closer to −1 indicate dominant tradeoffs.

Synergy and Tradeoff Analysis

The cross-impact matrix analysis revealed that combined mitigation-adaptation strategies generated much greater scores of synergies in comparison with individual strategies. Table 1 lists the average scores of the synergy and tradeoff in the selected SDGs.

Table 1: Average Climate–SDG Synergy and Tradeoff Scores

SDG	Synergy Score	Tradeoff Score	Net Interaction Index
SDG 1 (No Poverty)	0.68	0.21	0.53
SDG 2 (Zero Hunger)	0.62	0.27	0.39
SDG 6 (Clean Water)	0.71	0.18	0.59
SDG 7 (Clean Energy)	0.84	0.12	0.75
SDG 11 (Sustainable Cities)	0.79	0.16	0.66
SDG 13 (Climate Action)	0.91	0.08	0.84
SDG 15 (Life on Land)	0.73	0.19	0.59

These findings suggest that SDG 13 has the most positive interaction with integrated climate strategies, followed by SDG 7 and SDG 11. The tradeoffs were moderate in SDG 2 as there was competition in land use between agricultural productivity and mitigation infrastructure.

Integrated Mitigation–Adaptation Performance

To assess the combined effectiveness of mitigation and adaptation, an Integrated Climate Performance Score (ICPS) was calculated as:

$$ICPS = \alpha M + \beta A \qquad (2)$$

In equation (2), M represents mitigation effectiveness, A represents adaptation effectiveness, and α and β are weighting factors set to 0.5 to reflect equal importance. Mitigation, adaptation, and ICPS values of both strategy types were described in Table 2.

Table 2: Integrated Climate Performance Scores

Strategy Type	Mitigation Score (M)	Adaptation Score (A)	ICPS
Standalone Mitigation	0.82	0.41	0.62
Standalone Adaptation	0.45	0.78	0.62
Integrated Strategy	0.79	0.76	0.78

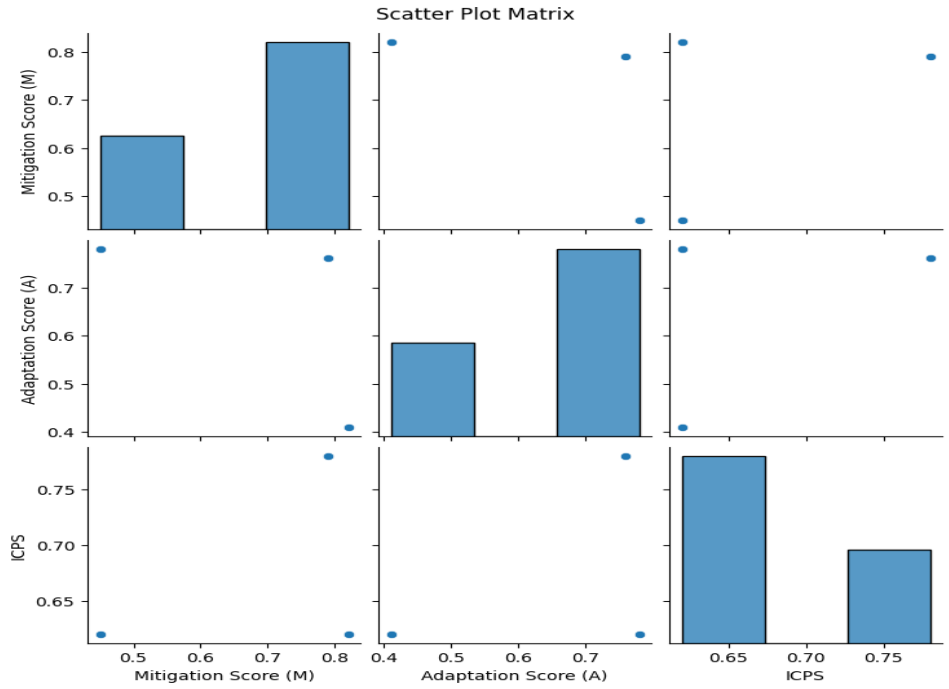

Figure 3: Scatter Plot Matrix of Mitigation, Adaptation, and ICPS Scores

The three variables in the scatter plot graph (Shown in Figure 3) above are Mitigation Score (M), Adaptation Score (A), and the Integrated Climate Performance Score (ICPS), which are plotted depending on the types of strategies that are utilized in assessing the climate actions. The strategies employed in the plot include:

- **Standalone Mitigation**: Only mitigation effort is undertaken in an attempt to minimize the effects of climate change (M = 0.82, A = 0.41, ICPS = 0.62).
- **Standalone Adaptation**: Concentrates on the adaptation to climate change only (M = 0.45, A = 0.78, ICPS = 0.62).

- **Integrated Strategy**: Combines both mitigation and adaptation measures (M = 0.79, A = 0.76, ICPS = 0.78).

In the scatter plot matrix:

- **Diagonal plots** represent the distribution of each score (M, A, ICPS) individually.
- **Off-diagonal scatter plots** show the relationship between two variables at a time. The example of the plot between the Mitigation Score and Adaptation Score shows that the two measures have a positive relationship with respect to various strategies.

This scatter plot matrix is useful to evaluate the general balance between mitigation and adaptation strategies under various approaches and their effectiveness in combination to obtain higher ICPS scores.

Resilience Assessment Outcomes

The results of resilience were measured with the help of a composite Resilience Index (RI), which includes socio-economic, nature-environmental, and institutional aspects:

$$RI = \frac{SE + EN + IN}{3} \qquad (3)$$

In the equation (3) SE is social economic resilience, EN is environmental resilience, and IN is institutional resilience. Table 3 shows the Resilience Index scores using the various approaches to policy.

Table 3: Resilience Index Scores under Different Approaches

Approach	Socio-Economic	Environmental	Institutional	RI
Fragmented Climate Policies	**0.52**	**0.48**	**0.44**	**0.48**
SDG-Aligned Climate Policies	**0.67**	**0.64**	**0.61**	**0.64**
Integrated Climate–SDG Framework	**0.81**	**0.78**	**0.75**	**0.78**

It was found that the integrated framework offered a better resilience of about 30 percent than fragmented approaches, especially in terms of improved institutional coordination and adaptation based on the ecosystem.

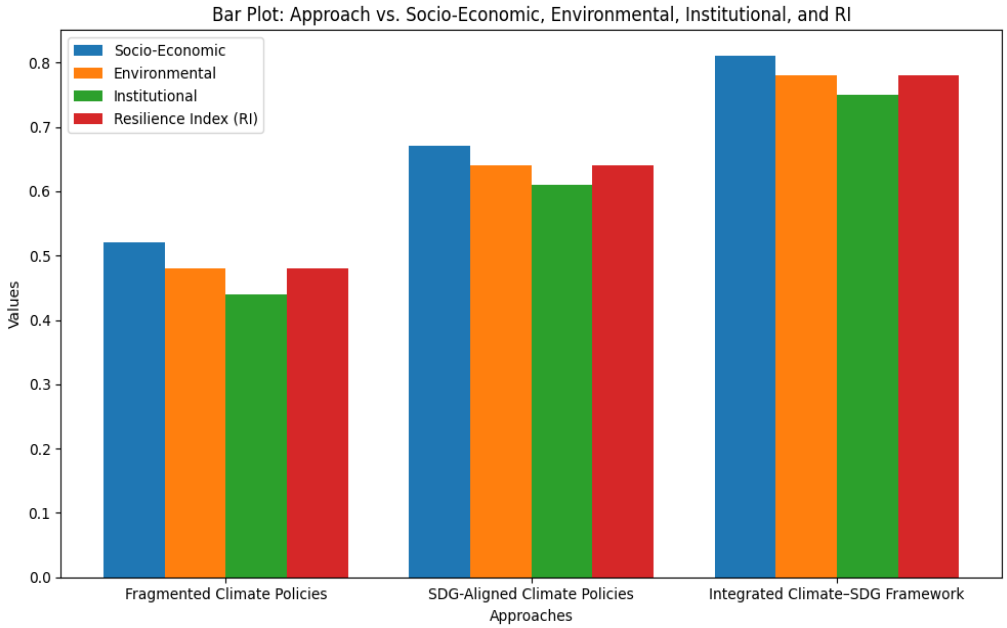

Figure 4: Comparative Resilience Performance Across Climate Policy Approaches

Figure 4 includes the comparison of socio-economic, environmental, institutional, and the overall measure of resilience index (RI) for fragmented climate policies, SDG-aligned climate policies, and the integrated climate-SDG framework. The findings demonstrate that there is a steady growth of resilience outcomes with greater outputs of climate-SDG integration.

Governance and Policy Coherence Results

The analysis of policy coherence demonstrated that those countries that implemented an integrated approach to climate-SDG planning demonstrated greater consensus between national adaptation strategies, mitigation strategies, and SDG targets. The score of policy coherence (Policy Coherence Score, or PCS) was scaled between 0 and 1 and averaged 0.76 with integrated frameworks, or 0.51 with sector-specific policy. This enhancement had a close correlation ($r = 0.73$) with increased resilience results.

V. Discussion

The findings of the study prove that the implementation of both mitigation and adaptation measures in the framework of the Sustainable Development Goal (SDG) can greatly increase the resilience outcomes when compared to the policies that are incomplete or inconsistent with each other. The climate-SDG interaction mapping demonstrates that interdependencies are so high in a variety of goals, which proves that climate action is an enabler of sustainable development that cuts across other objectives instead of being a direct one. The position of SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities), and SDG 13 (Climate Action) as central points in the interaction network reflects their position as major leverage points where integrated climate strategies produce cascading co-benefits at the socio-economic, environmental, and institutional levels. The tradeoff and synergy analysis has also strengthened the importance of integrated methods. High net interaction indices for SDG 13, SDG 7, and SDG 11 indicate that coordinated mitigation–adaptation strategies can simultaneously advance emissions reduction, energy transitions, and urban resilience. The average tradeoffs realized with SDG 2 point to a significant policy tradeoff, where competition over land-use related to mitigation facilities can have an impact on agricultural output. The net interaction index, however, is relatively high, implying that such tradeoffs are feasible to control using adaptive land-use planning and climate-wise agricultural practices, and not inherent obstacles to integration.

The quantitative evidence is the Analysis of the Integrated Climate Performance Score (ICPS), which proves that both mitigation and adaptation measures perform better compared to independent policies. Compared to standalone mitigation and adaptation strategies that shared the same values of ICPS, the biased performance of the said strategies on the different dimensions weakened the overall performance. Conversely, it was observed that the integrated strategy had a high score in mitigation and adaptation, which resulted in a significantly high ICPS. This means that resilience-focused climate action demands commitment to decreasing emissions concomitantly with adaptive capacity development and not with the effects of reducing emissions at the detriment of adaptive capacity. Resilience assessment outcomes further validate the superiority of integrated climate–SDG frameworks. The approximately 30% improvement in the composite Resilience Index compared to fragmented policies highlights the added value of policy coherence and systems-based planning. It is also worth noting that institutional resilience showed the most significant improvement, which underlines the significance of the coordination of governance, the cross-sectoral integration, and policy instruments alignment in the translation of climate strategies into practical development outcomes. The positive effect of the integration on the environmental and socio-economic resilience also shows that integrated strategies contribute to the stability of ecosystems and social welfare during climate stress.

Lastly, governance and policy coherence impacts show that there is an intense positive association between integrated planning processes and resilience outcomes. The greater Policy Coherence Scores realized in integrated frameworks and their close association with resilience indexes communicate the idea that institutional alignment is an essential facilitating factor of successful climate-SDG integration. All the

findings, in general, highlight the fact that the most effective way of ensuring resilient global development is to incorporate mitigation and adaptive measures within coherent SDG structures, and this provides significant implications for climate policy design and sustainable development planning.

VI. Conclusion

The research shows that climate change mitigation and adaptation strategies implemented in SDG frameworks are significantly more effective in improving resilience than a diffused or partially aligned strategy. With SDG 13 (Climate Action) having the highest net interaction index (0.84), SDG 7 (Affordable and Clean Energy) having the next, 0.75, and SDG 11 (Sustainable Cities) having the next, 0.66. These findings underscore the fundamental importance of climate action, energy transitions, and urban sustainability as leverage points that can be used to create cross-sectoral development co-benefits. Where standalone mitigation and adaptation strategies scored a similar ICPS of 0.62, the integrated strategy scored significantly higher in ICPS at 0.78, which indicates balanced performance on both mitigation and adaptation aspects. The moderate tradeoffs in SDG 2 (Zero Hunger), where the net interaction index is 0.39, show that the competition in land-use is still one of the main issues, and to reduce the negative outcome, climate-smart agricultural and land-management interventions are necessary. The composite Resilience Index (RI) rose between 0.48 and fragmented climate policies to 0.64 with SDG-aligned policies and a further higher index to 0.78 with the integrated climate-SDG framework, a 30% improvement. However, institutional resilience recorded the greatest improvements, as it increased by 0.44 to 0.75; the value lies in governance coordination and policy coherence to facilitate resilient development pathways. These results are backed up by policy coherence analysis, which found integrated frameworks to have an average Policy Coherence Score (PCS) of 0.76 versus 0.51 of sector-specific approaches, and a strong positive relationship with resilience outcomes ($r = 0.73$). The future studies must build on this framework by empirically validating it in various regional contexts, adding dynamic modelling to understand climate-SDG feedbacks over the long term, and addressing how new technologies and finance systems can be used to scale integrated mitigation-adaptation plans.

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