The combination of sustainable development and climate action: That includes SDGs in national climate strategies

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Abstract

Integrating Sustainable Development Goals (SDGs) into climate policies is essential for addressing climate change impacts and advancing sustainable development globally. This integration represents a profound shift in climate action, recognizing the inherent linkages between climate change and sustainable development. Scientific findings from the Intergovernmental Panel on Climate Change (IPCC) underscore the urgency of limiting global warming to 1.5°C to foster sustainable development. However, significant gaps persist in the current integration landscape, especially in economically dominant nations, where critical social SDGs remain inadequately integrated into Nationally Determined Contributions (NDC). Drawing on insights from the IPCC's Assessment Reports, this chapter emphasizes the imperative of deepening the integration of SDGs into climate policies to address underlying vulnerabilities and inequalities. It highlights the importance of inclusive stakeholder engagement, maximizing synergies between climate actions and SDGs, and addressing systemic knowledge gaps for evidence-based policy-making. Additionally, the paper integrates findings from Section 3, mapping interlinkages between SDG 13 (Climate Action) and other SDGs. This analysis underscores the complexity of these relationships and provides a network graph of climate and SDG interlinkages, along with insights into key factors and linkages. The chapter concludes by outlining policy implications, urging policymakers to enhance SDG integration into climate policies to ensure effective and inclusive responses.

Keywords: Climate action, Climate policies, Global warming, Intergovernmental Panel on Climate Change, Sustainable development goals.

Contents

Contribution of this paper to the literature
This study advances existing research by applying Natural Language Processing (NLP) to systematically map climate–SDG interlinkages across six IPCC Working Group III assessment reports, generating a network-based visualization of systemic linkages. Unlike prior sectoral analyses, it provides a comprehensive, system-level evidence framework for integrating SDGs into national climate strategies.

1. Introduction: A Multidimensional Framework for Climate–SDG Alignment

There is increasing agreement that the Sustainable Development Goals (SDGs) must be incorporated into climate policies due to the intensifying effects of climate change and the pressing need for sustainable development. This integration represents a fundamental shift in the way that climate action is conceptualized and carried out on a global scale, rather than just a strategic improvement. Key findings from the Intergovernmental Panel on Climate Change's Fifth Assessment Report (AR5) and Sixth Assessment Report (AR6), the Special Report on Global Warming of 1.5°C (SR1.5) (Roy, 2018), and the IPCC's Fifth Assessment Report (Denton et al., 2014; Fleurbaey et al., 2014) provide compelling scientific evidence for this necessity. These studies emphasize that keeping global warming to 1.5°C is not just a climate obligation but also a significant chance to promote sustainable development in a number of fields.

The understanding that climate change and sustainable development are inextricably connected provides justification for incorporating the SDGs into climate strategies. Climate change is a serious threat that might undo years of work toward development objectives, such as ending poverty and guaranteeing food and water security, which would have an impact on infrastructure, livelihoods, and health. On the other hand, a number of SDG-promoting tactics, like expanding access to clean energy, boosting health, and guaranteeing food and water security, can also have a major positive impact on the climate. For example, switching to renewable energy sources enhances public health by lowering air pollution and lowering carbon emissions.

The need to incorporate SDGs into climate strategy is urgent in both wealthy and developing nations. Developed countries frequently have the means and know-how to put high-impact climate solutions into practice, which can be in line with larger international commitments to sustainable development. Integration is even more crucial for developing nations, which often face greater vulnerability to the effects of climate change but also have a difficult time obtaining the resources required to put sustainable solutions into place. Developing nations may maximize their limited resources, draw in international climate finance, and carry out initiatives that concurrently fulfill several developmental and environmental goals by coordinating their climate policies with the SDGs.

Furthermore, encouraging inclusive stakeholder engagement requires that SDGs be incorporated into climate policies. This strategy promotes equality and inclusivity by guaranteeing that the opinions of the most disadvantaged groups are heard and taken into consideration in plans for climate action. A wider range of resources and creative solutions can be mobilized by including a wide range of stakeholders, such as local communities, civil society, and the commercial sector, which improves the effectiveness and sustainability of climate responses.

The importance of this integration is further demonstrated by its capacity to optimize synergies and manage trade-offs. For instance, biodiversity and food security may be impacted by land use regulations intended to lower emissions. A more comprehensive approach to planning and decision-making that acknowledges and balances these interdependencies is promoted by including SDGs in climate policies. It makes it easier to find win-win solutions that improve development outcomes and climate resilience, including agroforestry techniques that increase soil fertility and biodiversity while sequestering carbon.

Including the Sustainable Development Goals in national climate policies is not just a method to improve policy; it is also a vital step in making sure that climate efforts are inclusive, wide-ranging, and in line with the goals of the global sustainable development agenda. Aligning climate action with SDGs will be essential to coordinating inclusive and successful responses that protect the environment and advance a prosperous, just future for all as the world works to reach the targets of the Paris Agreement.

2. Review of Literature

Griggs et al. (2013) proposed that sustainable development should be redefined within planetary boundaries, emphasizing the integration of environmental sustainability with socio-economic advancement. They argued that climate stability was not merely an environmental concern but a precondition for long-term human development. Their framework repositioned climate action as central to poverty reduction, food security, and equity. The authors highlighted the interdependence between environmental resilience and economic growth. The study provided an early conceptual bridge linking global development goals with climate mitigation strategies. It demonstrated that isolated climate policies risked undermining broader development objectives. Their analysis contributed to shaping the post-2015 development agenda. The work laid foundational thinking for embedding climate considerations within SDG planning. It remained influential in guiding integrated sustainability frameworks.

Fleurbaey et al. (2014) examined the role of equity and justice in climate mitigation pathways within the IPCC Fifth Assessment Report. The study argued that sustainable development could not be achieved without incorporating fairness into climate policies. It analyzed how mitigation strategies affected income distribution, poverty, and social inclusion. The authors emphasized that social SDGs should be embedded within climate frameworks. They highlighted that unequal climate policies risked exacerbating vulnerabilities. The report stressed the ethical dimensions of climate governance. It proposed that equitable burden-sharing enhanced policy legitimacy. The study linked distributive justice with sustainable development pathways. It strengthened the normative case for integrating social SDGs into climate commitments.

Denton et al. (2014) explored climate-resilient development pathways and examined the intersection of adaptation, mitigation, and sustainable development. The study argued that development trajectories must be designed to withstand climate risks. It emphasized that climate vulnerability disproportionately affected low-income populations. The authors demonstrated that adaptation policies influenced food security, health, and infrastructure outcomes. They advocated for integrated planning to prevent maladaptation. The research showed that mitigation

alone was insufficient without resilience strategies. It highlighted the need for long-term systemic transformation. The study provided policy guidance for embedding SDGs into national climate strategies. It contributed significantly to climate–development integration debates.

Le Blanc (2015) conducted a structural analysis of the Sustainable Development Goals and examined the embedded interconnections among targets. The study demonstrated that SDG 13 was structurally linked to multiple other SDGs, including poverty, energy, water, and inequality. Through network mapping, the research showed that climate action functioned as a cross-cutting objective within the SDG framework. The findings suggested that progress in climate policy would inevitably influence several socio-economic goals. The study highlighted the need for policy coherence across sectors. It revealed that fragmentation in implementation could weaken systemic progress. The analysis reinforced the importance of integrated planning mechanisms. The work provided empirical evidence supporting the interdependent design of SDGs. It significantly informed discussions on SDG integration within climate strategies.

Nilsson, Griggs, and Visbeck (2016) developed a framework to systematically assess interactions between Sustainable Development Goals. They categorized linkages into reinforcing, enabling, constraining, and counteracting relationships. The study emphasized that climate action policies could generate both positive synergies and unintended trade-offs across goals. Their methodology enabled policymakers to identify areas of policy alignment and conflict. The authors argued that SDG implementation required systemic rather than sectoral planning. They demonstrated that energy, land use, and economic growth policies were deeply interconnected with climate mitigation. The study underscored the complexity of SDG interactions. It provided analytical tools for integrated decision-making. The framework became widely referenced in sustainability governance research.

Northrop, Biru, Lima, Bouye, and Song (2016) evaluated the relationship between climate commitments and national development strategies. The study analyzed pre-Paris climate pledges and assessed their alignment with long-term development objectives. It revealed that most commitments focused primarily on emission reductions. The research showed limited integration of poverty, inequality, and education goals within climate policies. The authors argued that this narrow approach risked undermining sustainable development pathways. They emphasized that climate commitments required multidimensional framing. The study highlighted the importance of embedding SDGs within NDC structures. It provided policy recommendations for enhancing integration. The findings supported arguments for comprehensive climate–SDG alignment.

Hallegatte et al. (2016) investigated the impacts of climate change on poverty and economic vulnerability. The study found that climate shocks disproportionately affected low-income populations. It demonstrated that without adaptive measures, climate change could reverse decades of poverty reduction. The authors argued that climate resilience was integral to sustainable development. The research emphasized the importance of integrating adaptation into development planning. It highlighted economic losses associated with climate inaction. The study connected vulnerability reduction with SDG achievement. It stressed the need for climate-inclusive growth strategies. The findings strengthened the developmental justification for SDG integration.

Pradhan, Costa, Rybski, Lucht, and Kropp (2017) conducted an empirical analysis of SDG interactions using cross-country data. The study identified statistically significant correlations between climate action and other development indicators. It revealed both positive and negative interactions across goals. The authors argued that policy prioritization required understanding these dynamics. They demonstrated that environmental goals influenced social and economic outcomes. The study emphasized systemic interdependencies in sustainable development. It called for integrated governance structures. The findings supported the view that climate action could not be pursued in isolation. The research contributed quantitative evidence to the climate–SDG linkage discourse.

Tosun and Leininger (2017) examined policy coherence for sustainable development and assessed institutional arrangements across countries. The study found that fragmented governance structures hindered effective SDG implementation. It argued that cross-ministerial coordination was essential for integration. The authors highlighted climate policy as a critical domain requiring alignment with development agendas. They demonstrated gaps between global commitments and domestic implementation. The study underscored administrative and political challenges. It suggested institutional reforms for coherence. The findings directly informed analyses of SDG integration in national climate strategies. The research strengthened governance-based perspectives on climate–SDG alignment.

Biermann, Kanie, and Kim (2017) explored governance architectures for implementing the Sustainable Development Goals. The study examined institutional arrangements required to achieve cross-sectoral coordination. It argued that effective SDG implementation demanded integrated governance systems. The authors emphasized that climate change represented a central cross-cutting challenge. The research showed that fragmented governance weakened sustainable outcomes. It proposed institutional reforms to improve policy coherence. The study linked governance innovation with climate resilience. It highlighted the need for global and national alignment mechanisms. The findings provided a structural foundation for integrating SDGs within climate policies.

Weitz, Carlsen, Nilsson, and Skånberg (2018) developed a systems approach to assess SDG synergies and trade-offs. The study emphasized that climate policies operated within complex socio-economic systems. It proposed analytical tools for evaluating cross-goal impacts. The authors argued that silo-based governance limited sustainable progress. They demonstrated that integrated strategies enhanced policy efficiency. The study provided methodological guidance for mapping interactions. It highlighted the need for institutional coordination. The findings reinforced systemic thinking in sustainability planning. The research informed multidimensional climate governance frameworks.

McCollum et al. (2018) employed integrated assessment models to evaluate synergies between climate mitigation pathways and sustainable development objectives. The study quantified co-benefits in areas such as air quality, energy access, and public health. It demonstrated that ambitious mitigation strategies could simultaneously advance SDG 7 and SDG 3. The authors emphasized that policy integration reduced overall transition costs. Their modeling revealed trade-offs in land use and food systems. The research supported coordinated energy transitions. It showed that systemic policy alignment maximized developmental gains. The findings reinforced the economic rationale for integrating SDGs within climate policies. The study provided empirical backing for multidimensional planning approaches.

3

Fuso et al. (2018) analyzed the relationship between SDG 7 (Affordable and Clean Energy) and other SDGs, particularly SDG 13. The study found strong positive interdependencies between renewable energy expansion and climate mitigation goals. It demonstrated that energy access improvements could reduce poverty and enhance economic inclusion. The authors highlighted policy coherence challenges in energy transitions. They warned that fossil fuel subsidies undermined both sustainability and climate targets. The research emphasized the centrality of energy systems in SDG integration. It advocated for cross-sectoral coordination mechanisms. The study strengthened arguments for aligning national energy strategies with climate commitments. It provided sector-specific evidence of climate–SDG synergy.

Pauw et al. (2018) conducted a content analysis of Nationally Determined Contributions (NDCs) submitted under the Paris Agreement. The study assessed how countries incorporated sustainable development objectives within climate commitments. It found that many NDCs referenced development rhetorically but lacked operational integration mechanisms. The research highlighted that social SDGs were often underrepresented. The authors emphasized that alignment between mitigation strategies and development goals remained inconsistent. They argued that clearer frameworks were required to measure SDG–climate linkages. The study demonstrated that stronger policy coherence enhanced implementation credibility. It provided empirical evidence of integration gaps. The findings reinforced the necessity of systematic SDG incorporation in climate strategies.

Nilsson et al. (2018) expanded earlier work by developing a scoring methodology to evaluate SDG interactions. The study provided a structured approach for identifying positive and negative policy effects. It emphasized that climate mitigation influenced economic and social outcomes. The authors demonstrated that integrated assessments improved policy prioritization. The research supported cross-sectoral planning strategies. It highlighted the importance of understanding indirect effects. The study strengthened methodological tools for sustainability analysis. It reinforced systemic thinking in policy design. The findings informed comprehensive climate–SDG integration approaches.

Dzebo, Janetschek, Brandi, and Iacobuta (2019) examined the governance mechanisms necessary to align climate action with Sustainable Development Goals. The study analyzed how national climate commitments addressed cross-sectoral development priorities. It found that while many countries acknowledged SDGs in principle, institutional coordination remained weak. The authors emphasized that integrated governance frameworks were essential for achieving climate–development synergies. The research highlighted that sectoral silos often limited policy effectiveness. It argued that climate mitigation strategies must explicitly consider social and economic dimensions. The study underscored the importance of multi-level governance in SDG integration. It concluded that systemic coordination improved policy coherence. The findings directly supported the need for multidimensional climate–SDG alignment.

Markkanen and Anger-Kraavi (2019) analyzed co-benefits arising from climate mitigation policies. The study demonstrated that well-designed mitigation strategies improved public health, employment, and social equity outcomes. It showed that renewable energy transitions reduced air pollution and enhanced well-being. The authors emphasized that co-benefits strengthened political support for climate action. The research argued that climate policies should be evaluated beyond emission metrics. It highlighted the distributional impacts of mitigation measures. The study reinforced the economic and social case for integration. It concluded that climate action and sustainable development could be mutually reinforcing. The findings supported multidimensional climate planning approaches.

Allen, Metternicht, and Wiedmann (2019) developed an analytical framework for understanding SDG interlinkages. The study emphasized the importance of system-level evaluation in sustainable development planning. It argued that SDG implementation required mapping complex interactions. The authors proposed tools to identify reinforcing and conflicting relationships. The research demonstrated that climate action influenced multiple development domains. It highlighted methodological challenges in measuring interactions. The study reinforced the need for integrated monitoring systems. It contributed theoretical depth to SDG integration analysis. The findings aligned with system-based climate–SDG frameworks.

Schipper, Eriksen, Carril, Glavovic, and Shawoo (2021) analyzed adaptation policies and their relationship with development goals. The study emphasized that maladaptation could undermine SDG progress. It argued that adaptation strategies must integrate social inclusion and equity. The authors highlighted the need for community-level participation. The research showed that resilience-building enhanced sustainable outcomes. It connected adaptation planning with poverty reduction. The study emphasized governance coordination. It reinforced the importance of embedding SDGs within climate resilience frameworks. The findings strengthened adaptation–development linkages.

Bennich, Weitz, and Carlsen (2020) investigated governance fragmentation in SDG implementation. The study demonstrated that overlapping institutional mandates hindered coordination. It emphasized that climate policy required horizontal and vertical integration. The authors highlighted the importance of cross-sectoral dialogue. The research showed that coherent governance structures improved sustainability outcomes. It argued that integration reduced duplication and inefficiency. The study strengthened the case for systemic policy frameworks. It reinforced institutional alignment as a precondition for SDG integration.

Zhou, Wang, Li, Zhang, and Liu (2022) applied network analysis techniques to map SDG interconnections. The study demonstrated that systemic modeling revealed hidden linkages. It emphasized the importance of data-driven approaches in sustainability research. The authors showed that network visualization enhanced policy understanding. The research highlighted energy and climate as central nodes. It provided methodological innovations for mapping interactions. The study supported system-level evidence frameworks. It reinforced the analytical value of network approaches. The findings aligned closely with systemic climate–SDG mapping methodologies.

Sachs, Lafortune, Fuller, and Drumm (2023) presented the Sustainable Development Report and SDG Index, offering comparative assessments of national progress. The study evaluated country-level performance across all 17 SDGs. It revealed significant regional disparities in SDG achievement. The authors highlighted that climate vulnerability constrained progress in several regions. The report emphasized the need for integrated policy frameworks to accelerate SDG implementation. It demonstrated that energy, climate, and social indicators were

interconnected. The study provided empirical benchmarks for evaluating policy alignment. It underscored governance challenges in developing regions. The findings informed comparative analysis of SDG integration in regional blocs.

2.1. Literature Gap

While existing literature acknowledges climate–SDG interdependencies and policy coherence challenges, three gaps remain:

1. Limited system-level mapping using longitudinal IPCC datasets.
2. Insufficient empirical comparison across G20, SAARC, and BIMSTEC.
3. Underrepresentation of social SDGs within climate policy integration studies.

This study addresses these gaps by applying NLP-based network mapping to six IPCC Working Group III reports and combining this with comparative policy analysis of major regional blocs.

3. Assessment of Current Integration Practices

3.1. Overview of SDG Integration in Climate Policies

Integrating Sustainable Development Goals (SDGs) into national climate policies is essential for ensuring that climate actions contribute effectively to sustainable development. This integration aligns climate policy frameworks with the SDGs, aiming to enhance synergies and manage trade-offs across economic, social, and environmental dimensions.

Globally, the recognition of the importance of integrating SDGs into climate policies is growing. However, the extent of integration varies significantly across countries and regions. Despite global agreements and the adoption of SDGs in 2015, many countries are still in the preliminary stages of incorporating these goals into their climate strategies. The United Nations report on "Synergy Solutions for a World in Crisis" (UNDESA & UNFCCC, 2023) highlights the benefits of coordinated actions between climate and sustainable development agendas, which can lead to greater achievements and mitigate the trade-offs often encountered when addressing these issues separately.

Integration issues are especially apparent in areas that are experiencing urgent climate changes and significant economic constraints. The main emphasis in many developing countries is on climate adaptation and mitigation, with little attention paid to how these tactics might also help achieve more general developmental objectives like reducing poverty and enhancing health.

3.2. SDG Integration in G20 Nations

In the G20, which includes the world's major economies and contributes significantly to global climate issues, the integration of SDGs into Nationally Determined Contributions (NDCs) shows a varied landscape. Notably, countries like Canada and Germany are incorporating educational and gender-responsive strategies into their climate actions. These initiatives aim not only to reduce emissions but also to enhance adaptability and resilience, illustrating the potential for multifaceted benefits such as improved health outcomes and economic opportunities.

Social elements are frequently underrepresented in the integration of social SDGs, such as SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-Being), SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 10 (Reduce Inequalities). The examination of the G20's NDCs makes this underrepresentation clear, especially for SDGs like education (SDG 4), gender equality (SDG 5), and decreased disparities (SDG 10). This research highlights the important gaps that may be filled by integrating these SDGs to improve more thorough and efficient climate governance.
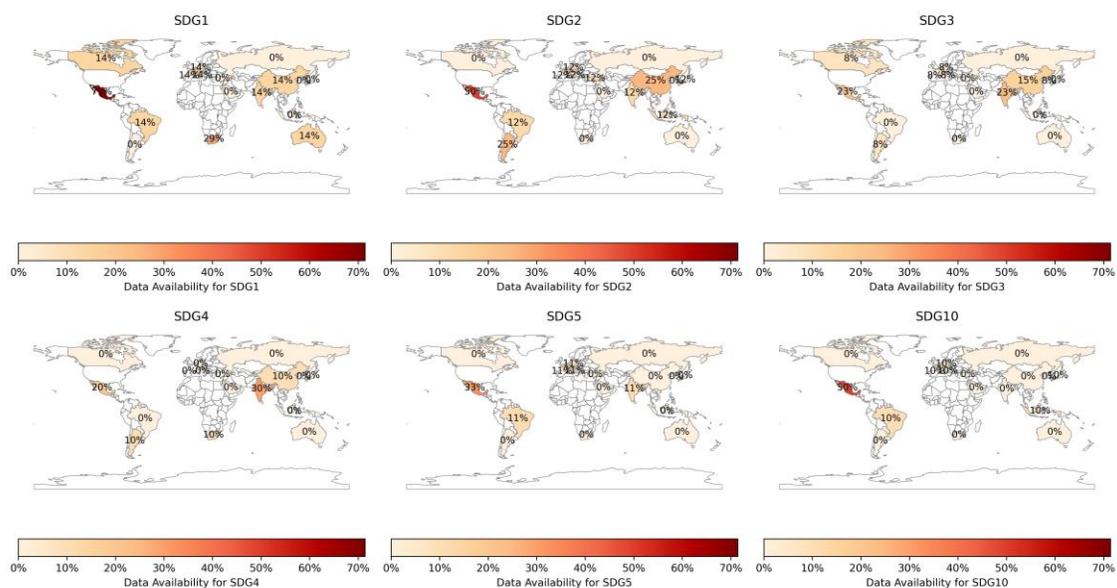
Figure 1. Integration of Social SDGs in G20's NDCs.

Note: The percentage value indicates the number of SDG targets reflected in NDCs as a share of the total number of SDG targets under that SDG.

Source: Compiled based on text analysis of G20's NDCs.

3.3. SDG Integration in SAARC Nations

Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka are members of the South Asian Association for Regional Cooperation (SAARC), which has made a number of sincere attempts to incorporate the Sustainable Development Goals (SDGs) into state policies. The majority of SAARC nations have matched the 2030 Agenda with their national development frameworks, despite regional disparities in progress. For example,

Bangladesh and India have created comprehensive SDG implementation plans with distinct monitoring metrics. While Nepal has localized SDGs into province planning following its federal restructure, Bhutan incorporates them into its Gross National Happiness (GNH) concept. Regional progress is hampered by issues like climate vulnerability, political unpredictability, institutional inefficiencies, and a lack of funding. The lack of cross-border cooperation limits the possibility of regional solutions to transboundary problems, including migration, water security, and climate change as well as shared learning. SDG results in South Asia could be accelerated by more regional collaboration, capacity-building, and resource sharing. Together with integrated policy frameworks, a regional SDG dashboard or index for SAARC can improve transparency and track group progress. In order to ensure inclusive, resilient, and sustainable development for more than 1.8 billion people, the SAARC region must transition from intention to implementation as the 2030 deadline draws near.

3.4. SDG Integration in BIMSTEC Nations

An important step toward inclusive regional development is the incorporation of the Sustainable Development Goals (SDGs) within the framework of the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation, or BIMSTEC. The BIMSTEC nations Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, and Thailand share developmental issues like poverty, inequality, climate vulnerability, and energy availability. Member countries have been increasingly aligning their national policies with the 2030 Agenda for Sustainable Development in recognition of these common issues. For example, Bhutan prioritizes Gross National Happiness in addition to SDG metrics, while India has included SDGs into its NITI Aayog plan. National SDG implementation roadmaps have been created and integrated into planning procedures in Bangladesh, Nepal, and Sri Lanka. As a regionalized SDG model, Thailand markets its "Sufficiency Economy Philosophy.
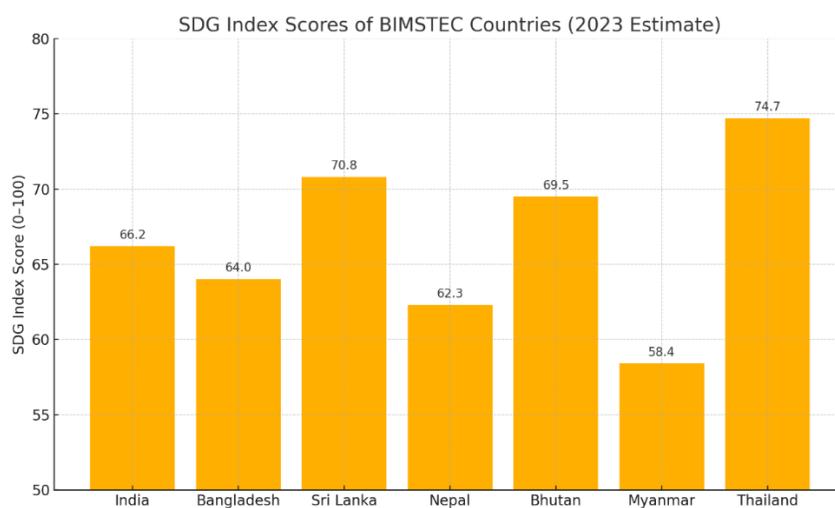

Figure 2. SDG Index scores of BIMSTEC Countries.
Source: Sustainable Development Report 2024.

Figure 2 illustrates the SDG Index scores of BIMSTEC countries, highlighting varying levels of regional progress. Thailand ranks first with a score of 74.7 in 2023, reflecting strong performance in sustainable energy, healthcare, and education. Sri Lanka (70.8) and Bhutan (69.5) follow, demonstrating emphasis on social development and environmental preservation. India, with a score of 66.2, shows steady progress but continues to face challenges in climate resilience and gender equality. Bangladesh (64.0) and Nepal (62.3) display moderate advancement, particularly in clean energy access and poverty reduction. Myanmar records the lowest score (58.4), largely due to political instability and institutional constraints. As shown in Figure 2, these disparities underscore the need for strengthened regional cooperation within BIMSTEC to accelerate collective SDG implementation.

3.5. Insufficient Integration and Implications

Particularly in economically powerful countries that have a big influence on international policies, the overall integration of SDGs into climate policies is still too shallow or limited. Climate policies run the danger of failing to address underlying vulnerabilities and inequities due to the low level of integration of essential social SDGs, which would undermine the development pathways' overall sustainability. In order to include the SDGs into climate strategies, this section urges governments to take a more integrated planning approach that takes sustainability's social, economic, and environmental facets into account. In addition to closing current divides, this kind of integration would strengthen the ability of the international community to address climate issues in a way that upholds justice and equity.

4. Analyzing the Systemic Links Between SDG 13 and Other Goals

4.1. Systemic Knowledge Gaps in Understanding Climate and SDG Interlinkages

Significant information gaps remain in properly comprehending the relationships between SDG 13 (Climate Action) and other Sustainable Development Goals, despite the valuable insights provided by assessments like the IPCC's AR6 and the Special Report on Global Warming of 1.5°C. The intricate and cross-cutting relationship between climate change and sustainable development is one major obstacle (Denton et al., 2014). Without taking into account all pertinent actions and SDGs under a single systemic framework, current assessments frequently examine these relationships sector-by-sector or action-by-sector. Critical interactions and co-benefits that are only apparent when looking at the system as a whole may be missed by this segmented approach.

The implications of these information gaps for integrated policy-making are significant. Policymakers may find it difficult to create plans that optimize synergies and minimize trade-offs if they lack a thorough grasp of how climate

policies relate to different developmental goals. Missed chances to use climate action for wider advantages like social justice, poverty alleviation, and economic growth may arise from this mistake.

Furthermore, the public's view of the significance of an integrated strategy may also be impacted by the lack of knowledge regarding these intricate relationships. It becomes difficult to garner broad support for such programs when the links between carrying out climate policies and accomplishing more general sustainable development goals are unclear or only partially understood. Comprehensive climate solutions that are seen as unrelated to or even harmful to other facets of societal advancement are less likely to be supported by the public and political players.

4.2. A Network Model Mapping Climate and SDG Interlinkages

This section introduces a novel network model on climate and SDG interlinkages from a system-based perspective to address knowledge gaps. Through a systematic review of six assessment reports of IPCC Working Group III (IPCC, 1990, 1995, 2001, 2007, 2014, 2022) the interlinkages between climate action (SDG 13) and other SDGs were mapped. To systematically process this vast amount of reference data and map climate and SDG interlinkages, a flow of data processing was developed using Natural Language Processing (NLP) techniques. This involved preprocessing data, extracting SDG key phrases, calculating the frequency of SDG key phrases in the text data, and mapping SDG key phrases based on co-occurrence. Finally, the results were visualized in a network graph (Figure 1) (Zhou et al., 2022).

Figure 3. Systematic data processing and mapping climate and SDG interlinkages using Natural Language Processing (NLP) techniques.

Figure 3 presents the systematic data-processing framework developed to map climate and SDG interlinkages using Natural Language Processing (NLP) techniques. The figure presents the sequential workflow beginning with IPCC Working Group III assessment reports (AR1–AR6), followed by text preprocessing and extraction of SDG-related n-grams. It depicts the identification of SDG key phrases, the calculation of their frequency, and the analysis of co-occurrence patterns. The mapped interlinkages between climate action (SDG 13) and other SDGs are then processed through a network modeling stage. Finally, the figure shows how the results are visualized in a network graph to represent systemic linkages. As illustrated in Figure 3, this structured methodological flow enables comprehensive mapping of climate–SDG interactions across multiple assessment reports.

Figure 4 shows a network graph that systematically maps and visualizes the connections between SDG 13 and other SDGs. With the SDG code in parenthesis, each node represents an SDG target, like energy (7.1), or an SDG, like water (6). The node's size indicates how frequently SDG key phrases appear in text data, whereas the SDGs' color indicates its hue. The co-occurrence frequency of pertinent SDG key words is shown by the width of each edge, which shows a link between two nodes. Key elements of climate action include energy (7.1), climate mitigation (13.2), land and land use (15.3), technology (17.7), taxation (17.1), investment (17.5), transportation (11.2), energy efficiency (7.3), infrastructure (9.1), water (6), fossil fuels (12.c), commerce (17.10), and more.

Figure 4. Visualization of climate and SDG interlinkages in a network graph.

Note: The code in parenthesis indicates the SDG code, and each node represents an SDG target. The color of the node indicates the corresponding SDG, and its size reflects the frequency of SDG key phrases in the text data. The co-occurrence frequency of pertinent SDG key words is shown by the width of each edge, which shows a link between two nodes. A minimum spanning tree is used to depict the graph, showing only the necessary edges to connect every node.

4.3. Key Climate and SDG Linkages

To enlighten on the main challenges and assist in setting priorities, it is crucial to understand the important links in the climate-SDG interlinkage system. The top 50 important links are shown in Figure 5 according to the frequency of co-occurrence. The frequency at which two SDG phrases appear together in a sentence without any guidance is known as the co-occurrence frequency. The most important connections in addressing climate change are those between energy and adaptation and mitigation, energy and technology, energy and land, and energy and climate change and mitigation. The text data's narratives describe the relationships between the various SDGs.

Understanding the main connections in the climate-SDG interlinkage system is essential for raising awareness of important concerns and helping to establish priorities. The top 50 important linkages are shown in Figure 5 according to the frequency of co-occurrence. The frequency of two SDG phrases occurring together (without guidance) in a sentence is known as the co-occurrence frequency. Energy and climate mitigation, energy and technology, energy and land, adaptation and mitigation, and climate change and mitigation are the most important connections in addressing climate change. The text data's narratives clarify the relationships between the various SDGs.
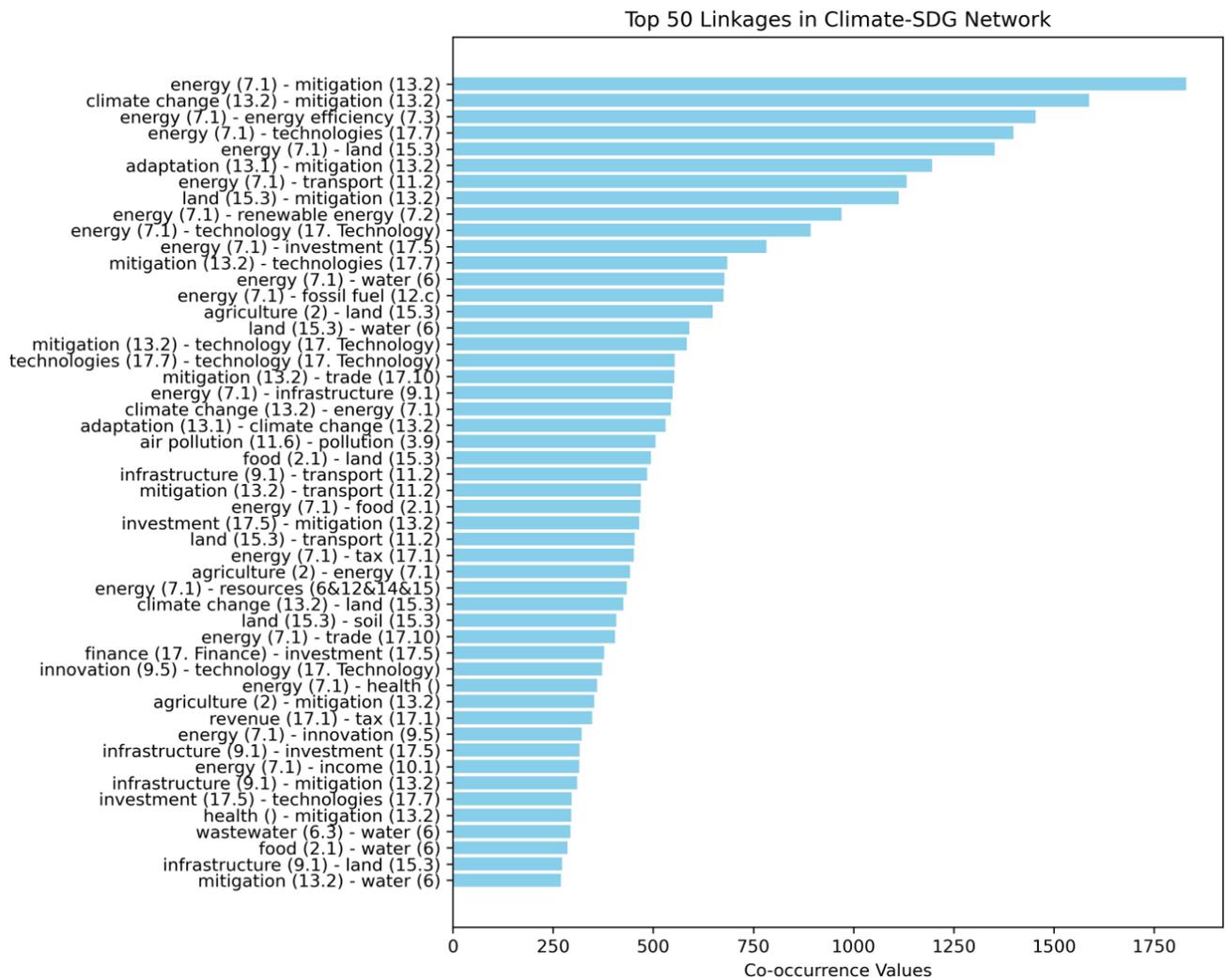

Figure 5. Key climate and SDG linkages ranked by co-occurrence frequency.

Note: The code in parenthesis represents either an SDG target (e.g., Target 7.1 for energy) or a broader goal (e.g., SDG6 for water).

5. Conclusion and Policy Implications

A revolutionary change in how countries handle both climate action and socioeconomic development is marked by the incorporation of the Sustainable Development Goals (SDGs) into climate policies. Instead of treating development and climate change as separate fields, this method emphasizes how closely related they are, with advancements in one directly affecting the other. The accomplishment of all 17 SDGs is seriously threatened by climate change, especially those pertaining to life on land (SDG 15), clean water (SDG 6), zero hunger (SDG 2), and poverty eradication (SDG 1). On the other hand, well-crafted climate policies that are in line with SDG principles can have a positive impact on several goals at once, including advancing renewable energy (SDG 7), sustainable cities (SDG 11), and climate resilience (SDG 13). The urgent need to keep global warming to 1.5°C is emphasized by the Intergovernmental Panel on Climate Change (IPCC), especially in its Special Report on Global Warming of 1.5°C and its Fifth (AR5) and Sixth (AR6) Assessment Reports. The threats to ecosystems, food security, water availability, and human well-being increase exponentially beyond this threshold, which is not arbitrary, particularly for populations who are already at risk. Unprecedented greenhouse gas emission reductions as well as revolutionary adjustments to the energy, agricultural, transportation, and land-use systems all essential to sustainable development are required to meet this goal.

Even though these synergies are becoming more widely acknowledged, the state of climate policy frequently fails to successfully integrate SDGs. Among the difficulties are disjointed institutional frameworks, inadequate funding, a lack of cross-sectoral collaboration, and inadequate data systems for monitoring advancement. Developing nations, in particular, must balance meeting their basic development demands with adapting to the more severe effects of climate change. Policy coherence must be improved through comprehensive stakeholder engagement, integrated planning, and customized climate finance structures in order to get beyond these obstacles. The world community

8

can only guarantee that climate action not only reduces risk but also promotes fair and sustainable development by achieving such alignment.

5.1. Several Policy Implications Can Be Drawn Up

- Strengthening the SDGs' incorporation into climate policies must be a top priority for policymakers. The sustainability of development paths is seriously threatened by the underrepresentation of important social SDGs in climate policies, such as gender equality, education, and decreased inequality. To guarantee that climate policies address underlying vulnerabilities and advance equity, policymakers must give top priority to including these social dimensions into climate strategies.

- In order to generate widespread support and mobilize resources for successful climate action, inclusive stakeholder involvement is crucial. To guarantee inclusive, egalitarian, and sustainable climate responses, policymakers should place a high priority on including a broad variety of stakeholders, such as local communities, civil society, and the commercial sector.

- Maximizing Synergies: To optimize resource allocation and accomplish several developmental and environmental goals at once, it is crucial to manage trade-offs and maximize synergies between climate activities and SDGs. To improve development outcomes and climate resilience, policymakers should use an integrated planning strategy that finds win-win solutions.

- Filling in systemic knowledge gaps about the connections between the SDGs and climate change is essential to supporting evidence-based policymaking. To better understand the intricate relationships between climate action and sustainable development goals, policymakers should give research and data collection activities top priority.

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