United Nations

Synergy Solutions for a World in Crisis:
Tackling Climate and SDG Action Together

REPORT ON STRENGTHENING THE EVIDENCE BASE | FIRST EDITION 2023

United Nations | Department of Economic and Social Affairs

United Nations Framework Convention on Climate Change

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This report serves a testament to the power of partnership, expertise, and dedication in advancing our understanding of the intricate interplay between climate action and sustainable development.

Preface

We welcome this first report of the expert group on climate and SDG synergies, which brings a critical message at a critical time: We must solve the climate emergency and sustainable development challenges together, or we will not solve them at all.

Halfway to the deadline for the 2030 Agenda, a mere 15 percent of SDG targets are on track. The climate crisis is worsening as greenhouse gas emissions continue to rise. Catastrophic and intensifying heat waves, droughts, flooding and wildfires have become far too frequent. United Nations Secretary-General António Guterres has called for an urgent course correction, stating that "climate action is the 21st century's greatest opportunity to drive forward all the Sustainable Development Goals" and urging world leaders to come together behind a rescue plan for people and planet — a rallying cry for synergistic action.

The expert group on climate and SDG synergies, co-convened by the UN Department of Economic and Social Affairs (UN DESA) and the UN Climate Change secretariat (UNFCCC), shows us in their report how the 2030 Agenda and implementation of the Paris Agreement are intrinsically linked — one cannot be achieved without the other. We must get the SDGs on track and keep the goal of 1.5 degrees alive.

The world will need to meet the daunting task ahead with unprecedented ambition and action. The expert group has gathered extensive research and case studies from around the world, and analyzed how synergistic action can generate many co-benefits and occasional trade-offs, with the positive impacts far outweighing the negative.

Greater institutional coordination and policy coherence across sectors and departments at the national level is needed, the expert group recommends, to better integrate SDG and climate policy and action, and the report states that governance and policy frameworks for both the Paris Agreement and the 2030 Agenda will need to be changed in order to align climate action with the SDGs. The group suggests that reporting mechanisms, such as the Nationally Determined Contributions (NDCs) under the Paris Agreement and the Voluntary National Reviews (VNRs) undertaken under Agenda 2030, should include synergistic targets or co-benefits, which is currently not common practice.

Political momentum has been building, with a growing recognition of the importance of synergistic action. Multi-stakeholder dialogues and engagement are also expanding. We are committed to continuing the annual conferences on climate and SDG synergies, which are growing in size and impact each year, and we intend to convene dialogues at the UNFCCC Regional Climate Weeks, COPs and other climate and SDG forums.

This expert group report comes at an opportune time. It will inform deliberations at both the SDG Summit and Climate Ambition Summit in September as well as COP 28. We are confident that it will spur additional efforts that can result in win-win outcomes for both climate action and the SDGs and transition us towards a just, equitable and sustainable world.

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Convention on Climate Change

List of acronyms

AFD	The French Development Agency
AIM	Asia-Pacific Integrated Model
BCE	Blue-carbon ecosystem
BRT	Bus rapid transit
BTR	Biennial Transparency Report
CDM	Clean Development Mechanism
COP	Conference of the Parties
CSA	Climate-smart agriculture
DALY	Disability-adjusted life years
DIE	German Institute of Development and Sustainability
EU	European Union
EV	Electric vehicle
EWD	Excess winter death
G7	Group of Seven
GAINS	Greenhouse Gas and Air Pollution Interactions and Synergies
GCAM	Global Change Assessment Model
GDP	Gross Domestic Product
GHG	Greenhouse gas
GRI	Global Reporting Initiative
GTP	Growth and Transformation Plan
HYBRIT	Hydrogen Breakthrough Ironmaking Technology
IAM	Integrated Assessment Model
IDFC	International Development Finance Club
IIRC	International Integrated Reporting Council
IPBES	Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
INFF	Integrated National Financing Framework
LT-LEDS	Long-term low greenhouse gas emissions development strategies
LEED	Leadership in Energy and Environmental Design
MESSAGE	Model for Energy Supply Strategy Alternatives and their General Environmental Impact
NAP	National Adaptation Plan
NCCAP	National Climate Change Action Plan
NDC	Nationally Determined Contribution
NGO	Non-governmental organization
NSDS	National Sustainable Development Strategies
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
RCP	Representative Concentration Pathway
SDG	Sustainable Development Goal
SDM	Sustainable Development Mechanism
SEI	Stockholm Environment Institute
SSP	Shared Socioeconomic Pathway
UNFCCC	United Nations Framework Convention on Climate Change
UNSDG	United Nations Sustainable Development Group
VNR	Voluntary National Review
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

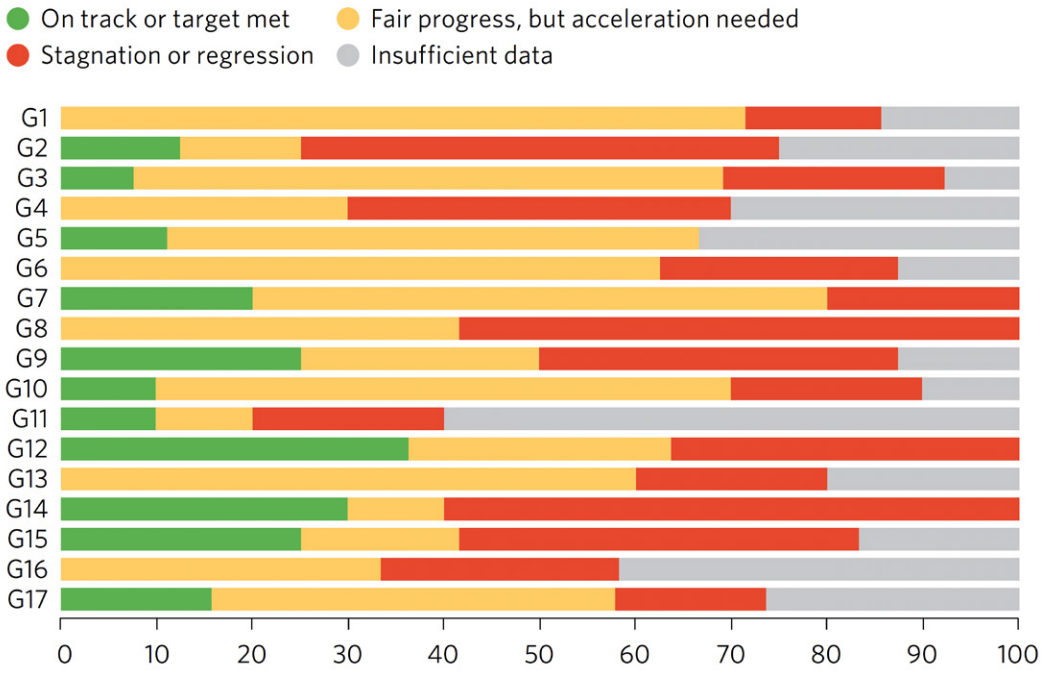
Executive Summary and Recommendations

We must change course. Without synergies, the Sustainable Development Goals (SDGs) and climate objectives remain out of reach. The evidence is clear: addressing climate change and achieving the SDGs are inextricably intertwined. Co-benefits far outweigh trade-offs. By maximizing these synergies, we can also bridge investment gaps worth trillions of dollars. Synergistic action should be a required component of national commitments, reporting and financing for climate and development goals. We must act on the climate emergency and sustainable development together now, or we risk not solving them at all.

1. Seeking win-win synergies by tackling the climate and sustainable development crises together is the only way to correct the course we are on.

The recent Sustainable Development Goals Report 2023: Special Edition paints a sobering picture of progress towards achieving the SDGs by 2030, stating: *"Halfway to the deadline for the 2030 Agenda we are leaving more than half the world behind. Progress on more than 50 per cent of targets of the SDGs is weak and insufficient; on 30 per cent, it has stalled or gone into reverse. These include key targets on poverty, hunger and climate. Unless we act now, the 2030 Agenda could become an epitaph for a world that might have been".* Similarly, the latest IPCC Synthesis Report finds that the global temperature

FIGURE ES-1. Progress assessment for the 17 SDGs based on assessed targets 2023, or latest data. The figure illustrates the percentage of progress of the targets that can be evaluated under each of the goals.



Source: UN Sustainable Development Report: Special Edition 2023.

TABLE ES-1. Global projected total GHG emissions and the estimated emissions gap under different scenarios in 2030.

	GHG emissions in 2030 ($GtCO_2e$) Median and range	Estimated emissions gap in 2030 ($GtCO_2e$)		
		Below 2.0°C	Below 1.8°C	Below 1.5°C
Year 2010 policies	66 (64–68)	–	–	–
Current policies	58 (52–60)	17 (11–19)	23 (17–25)	25 (19–27)
Unconditional NDCs	55 (52–57)	15 (12–16)	21 (17–22)	23 (20–24)
Conditional NDCs	52 (49–54)	12 (8–14)	18 (14–20)	20 (16–22)

Source: UNEP Emissions Gap Report 2022.

is already 1.1°C above pre-industrial levels and is likely to reach or surpass the critical 1.5°C tipping point by 2035. Catastrophic, intensifying and widespread heat waves, droughts, flooding and wildfires are becoming far more frequent. The 2022 WMO State of the Global Climate puts a spotlight on socio-economic and environmental impacts of the changing climate. According to the report, last year alone, continuous drought in East Africa, record breaking rainfall in Pakistan and record-breaking heatwaves in China and Europe affected tens of millions, drove food insecurity, boosted mass migration, and cost billions of dollars in loss and damage. Those impacts do not recognize borders, and thus require transboundary cooperation to manage them. Rising sea levels are threatening hundreds of millions of people in coastal communities.

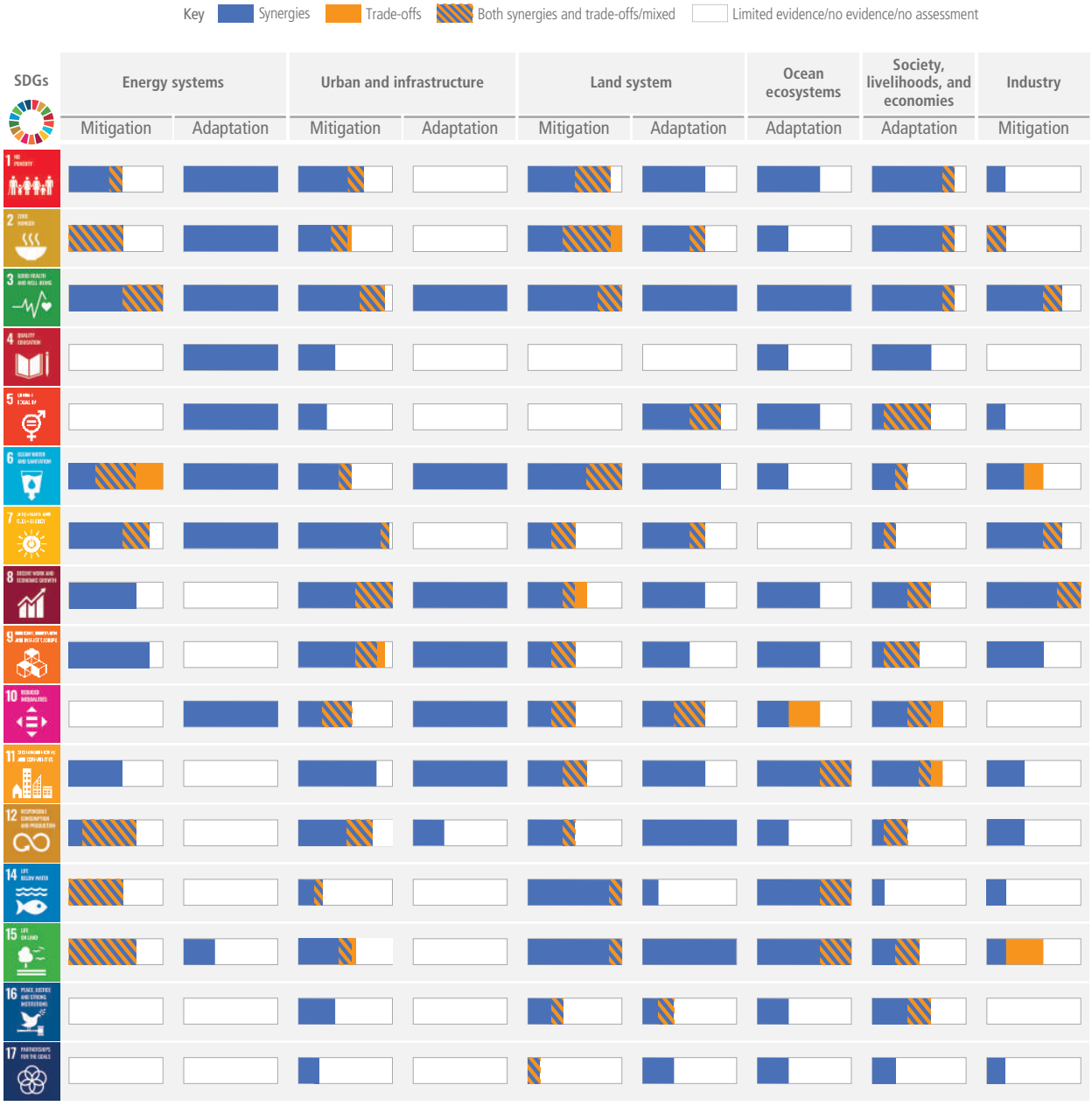
The 2022 UNEP Emissions Gap Report states: *"Policies currently in place with no additional action are projected to result in global warming of 2.8°C over the twenty-first century"* with *"countries off track to achieve even the globally insufficient NDCs."*

Earlier this year, the UN Secretary-General aptly characterized the state of the world as follows: *"We have started 2023 down the barrel of a confluence of challenges unlike any other in our lifetimes. Wars grind on. The climate crisis burns on. Extreme wealth and extreme poverty rage on. Epic geopolitical divisions are undermining global solidarity and trust. This path is a dead end. We need a course correction…."* Furthermore, he added, *"Climate action is the 21st century's greatest opportunity to drive forward all the Sustainable Development Goals"*. This was the Secretary General's urgent call for the need to act jointly on both the climate and the development agendas and to remind everyone that the 2030 Agenda for Sustainable Development and the Paris Agreement are intrinsically linked — one cannot be achieved without the other. A recent Nature editorial states *"The problem is not a lack of clarity…The science is clear: sustainability cannot be achieved without climate action, and vice versa. What's needed is a fight on both fronts…What the world needs is leaders who can build viable political coalitions to push for truly sustainable — and more-equitable — development"* (Nature 620, 921-922 (2023)).

This report demonstrates that aggressively acting on climate and development in an integrated and synergistic way is an important opportunity to achieve the course correction the UN Secretary-General has called for. It highlights some of the challenges but also the opportunities if the international community is seriously committed to enhancing these synergies and thereby addressing these challenges.

The report is designed to provide a broad overview of available data and evidence, insights from experts on the frontlines, and recommendations for enhancing synergistic action across the 2030 Agenda and the SDGs. This first edition will form the basis for future iterations, which will entail a wider scope of sectors, and thematic areas and deep dives on specific issues pertaining to strengthening and operationalizing synergic climate and SDG actions at all levels.

FIGURE ES-2. Near-term adaptation and mitigation actions have more synergies than trade-offs with Sustainable Development Goals (SDGs). The length of each bar represents the total number of mitigation or adaptation options under each system/sector. As the number of adaptation and mitigation options vary across system/sector, they have been normalized to 100% so that bars are comparable across mitigation, adaptation, system/sector, and SDGs.



Source: IPCC Synthesis Report 2023.

2. The vast pool of existing evidence underscores that the Paris goals and the SDGs are mutually re-enforcing and one cannot be achieved without the other.

Evidence indicates strong synergies between addressing climate change and achieving the SDGs, whereby advancements in one can lead to improvements in the other. Pursuing the 2030 Agenda and the Paris Agreement in concert can significantly and efficiently advance both agendas. Evaluating the co-benefits and trade-offs of climate action and SDGs is important to increase the cost-effectiveness of interventions and ensure a just and equitable transition.

Numerous examples (both theoretical and empirical) are provided in this report from current literature and available evidence that demonstrate the vast majority of mitigation and adaptation climate policies offer development co-benefits, including by improving health outcomes and reducing air pollution, reducing agricultural emissions, and by increasing food and water security and by reducing exposure to climate risks. For example, one study demonstrated how the energy system transition pledged under the Paris Agreement can significantly reduce global air pollution and avert up to 100,000 premature deaths annually in 2030, depending on the stringency of air pollution control measures, or by as much as 350,000 annually in 2030 under a more ambitious 2°C compliant pathway. Moreover, the co-benefits related to health and agricultural productivity were found to globally offset the costs of climate policy and contribute to increased global GDP. Converting old buildings to energy-efficient ones not only reduces GHG emissions but also provides employment and health benefits. Two million net jobs may be produced yearly by investing in building upgrades in OECD cities. The same level of investment in non-OECD cities may generate between 2–16 million net new jobs per year over the same timeframe. In addition to creating jobs, improved working conditions and a decline in morbidity make employees in energy-efficient buildings up to 16% more productive thus increasing GDP growth. Similarly, a shift to battery-powered electric vehicles reduces emissions and provides significant health benefits through reduced injuries and health risks, improved air quality, and reduced heat vulnerabilities, among others.

3. Progress away from siloed approaches and towards integrated planning, implementation, and reporting is underway but needs to move much faster.

Evidence pointing to the synergies between climate action and 80% of the targets in the 2030 Agenda highlights the opportunities of identifying and putting resources behind climate policies that have proved to generate a larger 'development dividend'. Signs of progress to leverage synergies at the national and local levels are on the rise, including in national commitments and reporting mechanisms, sectoral policies and enabling reforms, as well as local planning and budgeting instruments. Yet, it seems somewhat bewildering that such synergistic action is not the default position of policymakers at all levels. Testament to this is that in the main climate and SDG policy instruments, namely countries' Nationally Determined Contributions (NDCs), Long-Term Low-Emissions Development Strategies (LT-LEDS), National Adaptation Plans (NAPs) and Voluntary National Reviews (VNRs) respectively, very few, if any, specifically mention the other. Clearly, there must be a number of barriers preventing the widespread development and implementation of policies that simultaneously address the climate and development agendas. This report shows that these barriers are multifaceted and complex but are surmountable. Below we briefly summarize some of these barriers and provide recommendations as to how they might be addressed.

The generally poor adoption of a synergistic approach to addressing the 2030 Agenda and Paris Agreement can be attributed to a weak science-policy-society interface and there remains a sizeable disconnect between scientific evidence and applied policy action. Addressing this can ensure the best

scientifically verified policies are developed and implemented, and methodological weaknesses are addressed. To operationalize synergies, numerous knowledge, political and institutional, and economic barriers must be addressed, including:

Knowledge barriers

- **Lack of accessible, streamlined, and standardized methodologies.** There are a lack of *practical* methods and approaches for interaction mapping between climate action and the different SDGs, both in the literature and in practice, that are accessible for policymakers. In addition, model-based quantification methods are often associated with various assumptions, estimations, and uncertainties, resulting in variations in outputs that can limit their general usefulness for policy making. Part of the challenge in terms of allocating funding for co-benefits and/or synergies is the proliferation of tools with different data requirements. Perfect harmonization may not be feasible but efforts to build tools and methods that are robust, user friendly, and explicit about assumptions and data requirements are needed.

- **Lack of research, quality data, and comprehensive indicators at different levels and across all sectors.** With the exceptions of the co-benefits of climate action with air quality and health, and the synergies between a low-carbon energy transition and climate, there is a general lack of data and indicators to assess the synergies between the climate and SDG agendas at local, national, and international levels as well as across all sectors, including co-benefits of adaptation and resilience measures as well as issues pertaining to protection of biodiversity and nature-based solutions. Moreover, there are still persistent research gaps on the interlinkages between climate action and the SDGs, including the implications for a just transition. Increasing the level of collaborative research would not only address knowledge gaps but also build capacities.

- **Lack of capacity.** There is a critical worldwide shortage of skilled practitioners with the necessary knowledge to successfully identify and implement the cross-sectoral opportunities presented by a synergistic approach to climate and development. Action on climate and sustainable development requires a multidisciplinary and systems approach across both the knowledge and policy sectors that is often difficult, if not impossible, to attain without concrete steps to facilitate action beyond specific departmental or ministerial responsibilities.

- **Inadequate understanding of ways to address distributional impacts.** Understanding the distributional effects of climate action is essential to designing comprehensive policies that leave no one behind. The key is to promote just transitions, participatory approaches, and inclusivity at all levels. However, designing and implementing an inclusive policy may hinder the speed of transition. To understand the magnitude of the trade-off, we need to understand how to design mechanisms that facilitate the articulation and aggregation of diverse interests to support transitions that are quick, efficient, sustainable, and equitable. At the same time, most research and indicators measuring progress focus on averages rather than the distributional indicators. Thus, more research on inclusive policy assessment framework and data is required to achieve a just transition.

Political and institutional barriers

- **Governance and institutional settings.** Complex governance arrangements and institutional structural rigidity can impede synergistic action and integration due to factors like overlapping authority, lack of mandate, department-specific jargon, unequal access to information, and lack

of transparency. Moreover, politicians are not necessarily motivated to appeal to diverse interests; often being more inclined to support narrow vested interests. Furthermore, political incentives (electoral systems that discourage the entry of multiple parties, gerrymandering of districts, or campaign finance laws) can reinforce the incentives to cater to particular interest groups. Therefore, more thought needs to be put into how to alter incentive structures and motivate politicians to build multi-sectoral coalitions. Better coordination and enabling a systems perspective across government agencies could lead to a more effective and efficient use of limited resources and better outcomes.

- **Short term political cycles.** Differing political priorities and competing objectives are exacerbated by typically short-term political cycles when key ambitions are often traded off with each other and synergies can take time to materialize.

- **Lack of clarity on the distribution of accountability.** Pursuing synergies entails working outside different stakeholders' domains. With several departments often co-owning initiatives, accountability for different stakeholders can become blurred, priorities may become diluted, and the loss of control and autonomy may lead to significant inertia in advancing cross-institutional collaboration.

Economic barriers

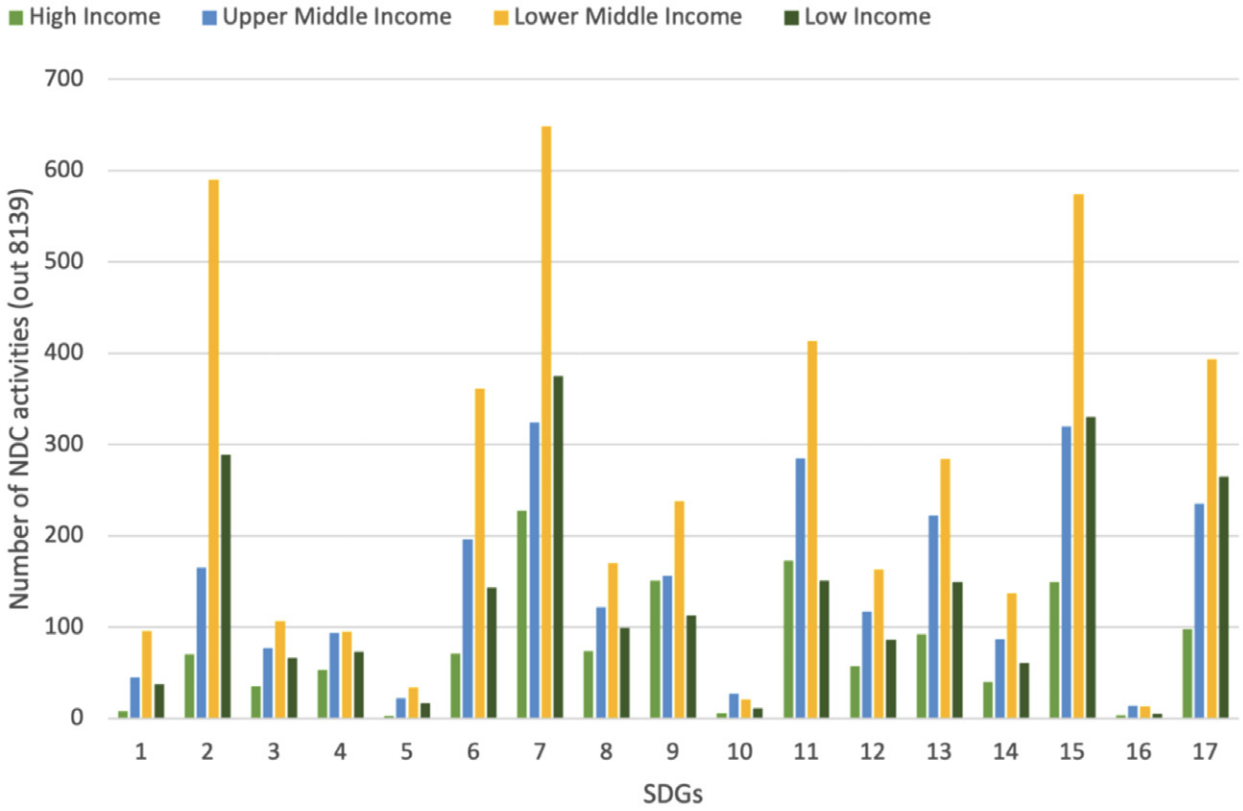
- **Inadequacy of funding.** Investments in both climate action and SDGs are inherently inadequate. The lack of commitment from developed economies and the poor understanding of the economic need to pursue synergies, as well as the ambiguous relationship between climate and development finance, can further affect investment financing. Considering the Paris Agreement and the 2030 Agendas in isolation and separately, the investment gaps in financing interventions can be daunting. This can be mitigated by investing in synergies between SDGs and climate, particularly for low, lower middle-, and middle-income countries where the two are highly intertwined, as synergies reduce the overall investment need compared to investing in them separately. Previous efforts to recognize and reward co-benefits in carbon finance mechanisms have not gained much traction because of often higher transaction costs, and they are not meaningfully integrated into the Global Climate Fund (GCF) or the NDC processes. More focused attention needs to be paid to financing synergistic action specifically.

- **Competing economic priorities.** Despite the rhetoric of the global importance of tackling the climate crisis and sustainable development, financing for these agendas is often compromised by what are often seen as more pressing priorities. Trillions of dollars have been spent in response to the COVID-19 pandemic both in direct relief and post-pandemic recovery. Although the need for such expenditure is undeniable, there has been a significant missed opportunity to direct recovery spending toward climate or development friendly projects. Likewise, global defense spending increased by almost 4% in real terms in 2022. Such competing priorities result in an ever-increasing shortfall in climate and development funding.

- **High or unclear transaction costs.** The ambiguous costs of assessing climate synergies and then determining how to allocate additional finance or non-monetary incentives for their achievement have led to a general lack of financing of synergistic action.

- **Synergies are not always a given.** Although rarely quantified, trade-offs are often observed for some SDGs that can impede the adoption of a synergistic approach. However, evidence suggests that co-benefits outweigh trade-offs in most cases.

FIGURE ES-3. Number of climate activities that correspond to each of the 17 SDGs across different regions.



Source: https://klimalog.idos-research.de/ndc-sdg

4. Synergies are highly dependent on national priorities and context

Central to the successful development and implementation of synergistic action on climate and development is an understanding that both agendas are context specific. Far too often such policies are enacted in a top-down one size fits all approach — by their very nature both agendas are global in outlook. However, implementation takes place at more local levels. Furthermore, there are significant differences between and within the countries of the Global North and Global South. For example, the interconnections between SDGs and climate action are more pronounced for low-income and lower-middle-income countries as SDG progress and financing gaps are far more pressing for these countries than mitigating the impacts of climate change. In contrast, having attained considerable progress towards the SDGs, the primary focus for high-income countries is meeting their pledged targets under the Paris Agreement.

Emissions reductions through land use regulation, which also advances several SDGs, have been far more prominent in the Global South. In the Global North, synergies have more often been utilized through the region's route to a clean energy transition, although this is also increasingly emerging in the Global South. In general, however, the key is the context and scale specificity and dependency of national priorities and endowment.

At a more local scale, cities, and urbanization, particularly in the Global South, present both challenges as well as myriad opportunities for synergistic action. Their rapidly changing environment offers opportunities for innovative approaches to synergistic action compared to cities that are well developed where there is little scope for transformative change at scale.

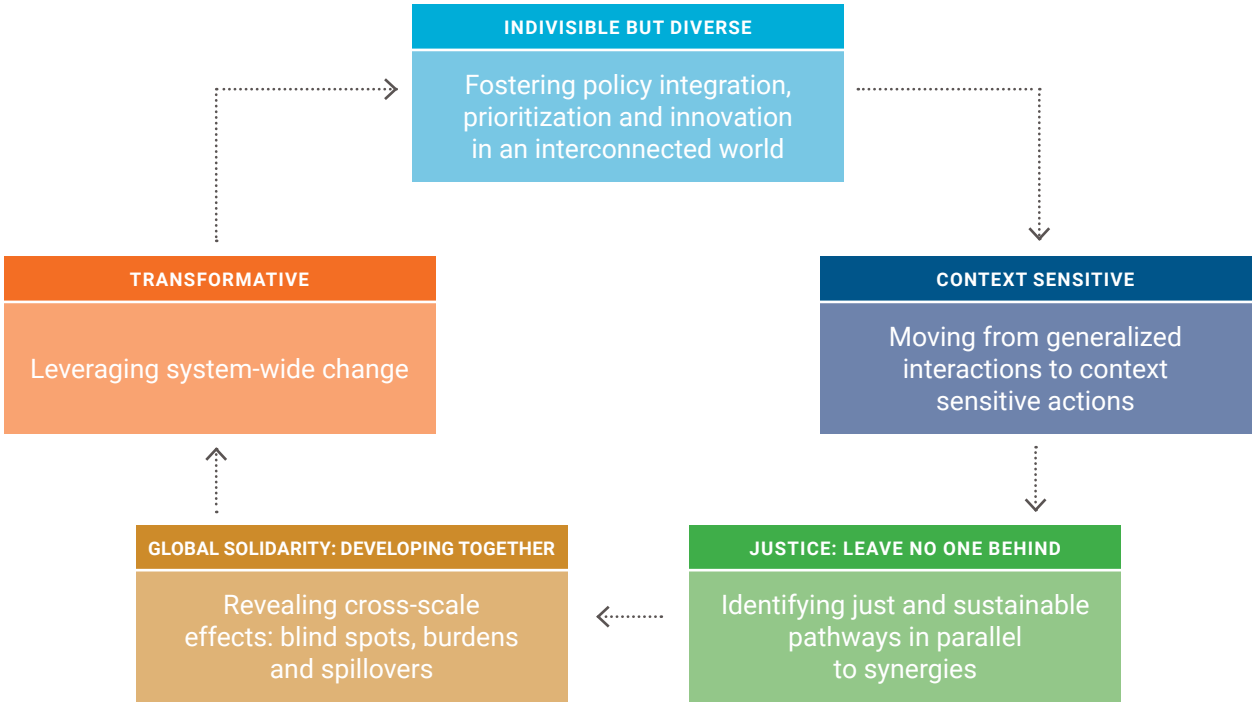
5. The way forward – A 'framework for action' to foster systemic change

Despite the abundance of data, tools, and methodologies addressing the potential climate and SDGs synergies (as provided in this report), there is a lack of a holistic approach that is accessible to policy makers. Most of the existing information is 'hidden' in the academic literature, research institutions, government departments, or NGOs. Often, what is available lacks direct relevance to policy makers or cannot be used due to its format.

We propose to develop a 'framework for action' founded on existing knowledge, tools, and evidence on the interconnectedness of sustainable development and climate action to enable the systemic identification, review, and evaluation of complex synergistic action and importantly an assessment of their transformative potential. We present five principles that should be the basis upon which a framework be developed, namely:

- *Indivisible but diverse: Fostering policy integration, prioritization, and innovation in an interconnected world*
- *Context sensitive: Moving from generalized interactions to context sensitive actions*

FIGURE ES-4. The five principles of the framework



- *Justice: leave no one behind: Identifying just and sustainable pathways in parallel to synergies*
- *Global solidarity: Working together: Revealing cross-scale effects: blindspots, burdens and spillovers*
- *Transformative: Leveraging system-wide change*

To clarify the intended and unintended outcomes of specific actions, the proposed framework will move from a focus on policy and target synergies to systemic and participatory tools and methods. These would allow the framework to make sense of complex social, environmental, and economic information. It will combine innovations in SDG interaction studies with tools and knowledge on the interconnections between countries, scales, time frames, and equity and sustainability to highlight the potential for synergies. In addition, it will also reveal the potential for positive and negative spillover effects and impacts on vulnerable people and places, many of which are current blind spots in synergistic efforts and frameworks.

The framework will also offer tools to identify leverage points and transformative potential to cluster, prioritize, and deepen the resultant sets of synergies and synergistic action. This will move beyond efforts that currently focus on the tangible and easy to measure. It will ensure that these useful interventions are complemented by actions that foster systemic changes addressing the current 'sustainability gap' — the gap between the transformative ambition of the SDGs and the Paris Agreement, and the incrementalism of current interventions.

6. Recommendations

The following is a concise set of ten forward-looking recommendations for accelerated action on climate and SDGs synergies. These recommendations are designed to address two critical questions posed in this report: Why is synergistic action not happening at the necessary level? What needs to be done to make it happen?

The report is an initial phase of work that will be continued to: (i) develop deeper analysis, more data, and a full framework for action that can be used by policy and decision makers to promote synergies; and (ii) a set of recommendations in support of the major summits to take place in 2024, particularly the Summit for the Future.

1. **Enhance collective resilience against current and future global crises through collaboration and cooperation with international organizations and their partners.**

   Global crises such as wars, pandemics, natural disasters, and political upheaval have undone much of the progress made in SDGs and climate action. However, such events have also revealed opportunities to undertake synergistic action by highlighting the impact of science-based policy advice and the potential for rapid lifestyle and behavioral changes. National governments need to work in collaboration with international organizations and their partners to improve their resilience against the impacts of such crises by pursuing the agenda for synergistic action.

2. **Strengthen science-policy-society interaction to advance synergistic action.**

   One of the major challenges associated with advancing climate and SDG synergistic action by policy and decision makers is the disconnect that exists between scientific evidence and policy action.

Despite evidence suggesting that pursuing the 2030 agenda and the Paris Agreement in concert can significantly advance both agendas and result in win-win situations, evidence is dispersed and often difficult, if not impossible, to access. This major challenge for policy and decision makers interested in enhancing these synergies can be mitigated by a widely accessible global knowledge platform that systematically gathers evidence and strengthens requirements for reporting. Such a platform could contain scientific (including indigenous and traditional knowledge) and anecdotal evidence and serve as a compendium of best practices. Better utilization of existing platforms and processes, such as the UNFCCC Enhanced Transparency Framework, for knowledge exchange, experience sharing, and capacity building could also encourage synergistic action. Such platforms and processes are important to foster stronger relationships between researchers of different disciplines, policy makers, and civil society (business, NGOs, academia, etc.). This will not only help ensure that the best scientifically verified policies are developed and implemented, and methodological weaknesses addressed, but also provide policy makers with a menu of possible solutions based both on scientific and anecdotal evidence. Greater access to information can also promote participation by all sectors of society, thus ensuring greater success in implementation.

3. **Promote institutional capacity building and cross-sectoral and international collaboration at national, institutional, and individual levels, especially for the Global South.**

   One of the major barriers to the advancement of a just transition and equity requiring major attention and investment is the weak and unequal scientific and political capacities in many countries, particularly low-income countries. There is a globally recognized need to frame the progress and impacts of the 2030 Agenda and climate action at the local level to contextualize the synergies. Top-down approaches that seek to apply generalized approaches and measures across different countries and cities prevent the localization of climate and development challenges, which are often shaped by local contexts and addressed by local capacities. This localization of climate and development challenges, however, requires the adoption of multidisciplinary and systems approaches, and multi-stakeholder groups and processes, which demand awareness as well as commitment and capacity that is not always found in many countries, particularly low-income countries.

4. **Ensure policy coherence and coordination among policy makers across sectors and departments for enhancing climate and development synergies at the national, sub-national, and multi-national levels.**

   Governance and institutions play a key role in the policy coordination required for supporting synergistic action. There needs to be greater institutional coordination and integration of SDG and climate policy development and implementation particularly at national levels. This requires the systematization of information sharing, data-driven decision making, and collaboration on shared priorities between departments participating in SDG and climate implementation as well as research institutions. Coordinated, cross-ministerial efforts built upon strong political will are also required to implement both agendas. Transboundary cooperation can also facilitate cross-sectoral cooperation, increase efficiency, and support coherent achievement of climate action and SDGs. Policy coherence and coordination are also crucial to address the trade-offs associated with linear climate and developmental action and ensure a just transition by promoting systems thinking.

5. **Develop a 'framework for action' that can help decision makers in public, private, and civil society sectors identify synergistic action for systems change.**

   This framework for action should be designed to enable the identification, review, and evaluation of complex synergistic action, and most importantly an assessment of their transformative potential (*i.e.*, their potential to inform and support profound systems change). The objective is to move beyond a reliance on incremental improvements or adjustments that dominate sustainable development and climate efforts and instead focus on system-wide and transformative changes in the economic, political, and socio-cultural systems and institutional structures. This framework for action should build on existing tools, evidence, experience, and methods from research and practice.

6. **Use the 'framework for action', to ensure a just transition.**

   An important challenge often overlooked is that focused efforts on synergies alone, which tend to prioritize action, risks undermining justice as a core value and leaving vulnerable groups and regions often linked to less synergistic targets behind. As covered in this report, some studies of SDG interaction have shown that there will be cases where some groups will benefit from synergistic action, some groups may not benefit, or worse, may incur the risks and the costs of the action. Studies of SDG and climate interaction must be used to identify not only synergies but also critical negative impacts on policy areas and targets ensuring no one is left behind, a key feature of the framework for action in this report.

7. **Address the large investment gaps in the climate and development agendas to enhance the necessary synergies and lead to the effective allocation of national budgets.**

   Large investment gaps, rooted in the deep failure of the global financial architecture and finance fragmentation, are emerging as one of the major barriers to effective climate and development action and their synergies. These failures can be characterized as follows: failure to invest in the amounts needed; failure to invest in the areas most in need; lack of sufficient mechanisms to ensure that investments are sustainable; lack of accountability measures to ensure that lending by public institutions (Multilateral Development Banks (MDBs) and International Financial Institutions (IFIs)) are fully aligned to SDG and Paris Agreement implementation; and finally the absence of sufficient collaborative frameworks for public and private institutions to work together. Current efforts to address these failures at the international level could include measures that encourage MDBs and IFIs such as the World Bank and regional development banks to introduce instruments that enhance climate and development synergies. There is also a huge finance gap at the subnational and city level due to prevalent barriers to accessing available financing. Thus, there is a need for a well-designed and well-managed city climate finance program to reduce the finance gap for SDGs and climate action.

8. **Utilize COP 28 in Dubai to initiate and accelerate synergistic action on climate and SDGs and make it an essential part of reporting by Parties.**

   As this report has shown, synergistic action is essential for the successful implementation of the Paris Agreement and Agenda 2030. Unfortunately, reporting on them in NDCs, NAPs, LT-LEDS, VNRs, and other national reports is low and, in some cases, nonexistent. This year's COP 28 can be used to encourage synergistic action and reporting, including: recommending countries articulate SDG implementation and the social aspects of their analysis in the new NDCs due to be submitted in 2025; report on progress within the Biennial Transparency Report (BTR) under the UNFCCC Enhanced

Transparency Framework, as well as in any future submissions of NAPs; highlight through the Global Stocktake (GST), opportunities for enhanced climate ambition and implementation through climate and development synergies; updating the guidance on NDCs to require information on synergies with SDGs; and finally, urging that synergies with SDGs form a key consideration in the formulation and updating of LT-LEDS.

9. **Prioritize the role of synergies in the work of the UN and international financial institutions, including an improved system for sharing information to help countries in their reporting responsibilities, enhanced cross-sectoral engagement in the UN's intergovernmental and capacity building efforts, and focused attention on climate and development synergies as well as climate resilient development pathways in the IPCC AR 7.**

   UN agencies, the World Bank, and IFIs have an important role to play, not only in providing funding for the enhancement of climate and development synergies, but also for the provision and sharing of data and information across sectors and geographies. This would not only enrich the overall availability of data but also help low-income countries cope with, and improve, their current reporting requirements. Previous IPCC reports, especially AR 6, placed great emphasis on climate and development synergies. The AR7 could dedicate one chapter exclusively to climate and development synergies through Working Group 3.

10. **Treat cities, sites of major population growth and expansion of economic activities, as an opportunity for focusing on climate and development synergies.**

    Approximately 56% of the global population lives in cities. This is expected to grow to 70% by 2050. Thus, cities present both a major challenge as well as an opportunity for focusing on climate and development synergies. Well-managed growth could not only avoid the uncontrolled growth of carbon emissions and the threat to wellbeing, particularly for the poor and the marginalized, but also bring sustainable growth, innovation, and improvements in wellbeing. One effective way to promote this outcome is through special programs that focus on enhancing climate and development synergies in cities. There are many examples of cities where these synergies have brought major benefits in sustainable transport, sustainable use of urban space, lower greenhouse gases, and improvements in wellbeing. A global program that focuses exclusively on synergies in cities would provide major benefits in both the climate and development agendas.

1. Background and Scope

1.1 History

In his recent briefing to the General Assembly, the UN Secretary-General stated, *"Climate action is the 21st century's greatest opportunity to drive forward all the Sustainable Development Goals"*. This was his urgent call for the need to act jointly on both the climate and the development agendas and to remind everyone that the 2030 Agenda for Sustainable Development and the Paris Agreement are intrinsically linked — one cannot be achieved without the other.

This report builds on the recent history of global conferences designed to promote synergistic action between the Sustainable Development Goals (SDGs) and the climate agendas. The Copenhagen Conference in 2019, the Webinars of 2020 and 2021, and the Third Global Conference on Synergies of 2022 provide the platform, rationale and urgency for this report.

The argument made in this report is that despite the importance of climate and SDG synergies in advancing both the 2030 Agenda and the Paris goals, current analyses and data on interlinkages between the SDGs and climate action remain uneven and scattered across various sources. Furthermore, to date, there is no global authoritative resource dedicated to the topic of climate and SDGs synergies. The most recent report on this topic, the Third Global Conference on Climate and SDGs Synergies proposed a set of key recommendations, including the need to strengthen the evidence base for synergistic action. The purpose of this report is to provide an assessment and a guide for this synergistic action.

The key recommendations of the Third Global Conference for actions that could enhance synergistic action and that are addressed in this report include:

- Strengthening the evidence base for synergistic action.
- Enhancing integrated planning.
- Scaling up capacity building and sharing best practices.
- Developing and promoting partnerships for transformation.
- Convening multi-stakeholder dialogues at all levels.
- Informing key intergovernmental processes on climate and the SDGs.

The report also builds on the major achievement of the two negotiations of 2015 that delivered the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change. For the first time, the linkages between climate and development were enshrined in each of the key documents of these negotiations. In the Paris Agreement, in which its long-term goals are framed in the context of sustainable development, it was done in recognition that climate change and development need to be addressed together to not only avoid harmful tradeoffs and high costs, particularly for poorer countries, but also to exploit the benefits that come from strengthening these linkages. This report assesses what impact these breakthroughs in the negotiations have had and the reasons why progress in synergistic action has been slow and, in some cases, non-existent.

1.2 Purpose of the report

The fundamental purpose of this report is to advance climate-SDG synergistic action, including by:

- Reiterating the case for synergistic action.
- Taking stock of the theory and practice of climate-SDG synergies, including evidence about synergistic action and the underlying resources, approaches, and tools.
- Identifying the critical barriers to synergistic action and possible ways to overcome them.
- Providing a practical, tractable framework for advancing synergistic action, and indicating what further work is required to ensure its implementation.
- Making recommendations for policy and decision makers responsible for operationalizing climate and development synergies.

The report addresses the following problems and challenges:

- Despite the rhetoric on the importance of synergies and the need to enhance co-benefits and avoid trade-offs, there has been very little action on the ground — How can this problem be addressed?
- Notwithstanding the increasing recognition that synergies can result in win-win situations, evidence is dispersed, scattered, and often not easily accessible — Should a global platform that gathers this evidence be created?
- The lack of approaches and practical tools for a) identifying and enhancing synergies, and b) for policy makers to enable and promote synergies — Would an analytical framework that is easy to use by policy makers be a good solution?
- Should the current efforts to reform the global finance architecture for development and climate include having a critical impact on progressing synergistic action — What should such reforms look like?
- If synergies are so essential for the successful implementation of the Paris Agreement and Agenda 2030 should not reporting on them be made a prerequisite?
- How can the topics of just transitions, leaving no one behind and equity be given higher attention in this and other debates?

1.3 Current global context

The recent Sustainable Development Goals Report 2023: Special Edition paints a sobering picture of progress towards achieving the SDGs by 2030 stating *"Halfway to the deadline for the 2030 Agenda we are leaving more than half the world behind. Progress on more than 50 per cent of targets of the SDGs is weak and insufficient; on 30 per cent, it has stalled or gone into reverse. These include key targets on poverty, hunger and climate. Unless we act now, the 2030 Agenda could become an epitaph for a world that might have been"*. Similarly, the latest Intergovernmental Panel on Climate Change (IPCC) report finds that global temperature is already 1.1 °C above pre-industrial levels and is likely to reach or surpass the ambitious 1.5 °C goal by 2035. Catastrophic and intensifying heat waves, droughts, flooding, and wildfires have become far more frequent. Rising sea levels are threatening hundreds of millions of people in coastal communities. Those impacts also do not recognize borders; thus, require transboundary cooperation to manage them.

In his brief to the General Assembly earlier this year, the UN Secretary-General aptly characterized the state of the world as follows: *"We have started 2023 down the barrel of a confluence of challenges unlike any other in our lifetimes. Wars grind on. The climate crisis burns on. Extreme wealth and extreme poverty rage on. Epic geopolitical divisions are undermining global solidarity and trust. This path is a dead end. We need a course correction…."* A recent *Nature* editorial states *"The problem is not a lack of clarity…The science is clear: sustainability cannot be achieved without climate action, and vice versa. What's needed is a fight on both fronts…What the world needs is leaders who can build viable political coalitions to push for truly sustainable — and more-equitable — development"* (Nature (Editorial), 2023, p. 922).

The argument of this report is that aggressively acting on climate and development in an integrated and synergistic way is one important way to achieve this course correction. This report highlights some of the challenges but also the opportunities if the international community is seriously committed to enhancing these synergies and thereby addressing these challenges.

The upcoming critical milestones such as the SDG Summit in September 2023 and the Global Stock Take at COP28 in December 2023 will assess our collective progress toward meeting the goals of the Paris Agreement and the 2030 Agenda. These landmark events also serve as moments to take a deeper look at synergistic action between these two critical agendas, including national instruments such as the Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs), Long-Term Low-Emissions Development Strategies (LT-LEDS), and the Voluntary National Reviews (VNRs), towards just, equitable, and climate compatible pathways. This report will advance some recommendations that can be considered during these major summits.

2. Advancing Climate Action and SDG Synergies

2.1 The Science

2.1.1 An introduction to synergies, co-benefits, and trade-offs

Climate change is considered one of the greatest threats to sustainable development, having extensive and unprecedented repercussions on social, economic, political, and environmental dimensions that are further amplified among marginalized populations (Fuso Nerini *et al*., 2019; P. Thapa *et al*., 2023). Being embedded in the 2030 Agenda as an SDG itself (SDG 13: Take urgent action to combat climate change and its impacts), studies have shown that climate change can make SDG targets harder to achieve (Cohen *et al*., 2021; Fuso Nerini *et al*., 2019; Mugambiwa & Tirivangasi, 2017). In sub-Saharan Africa, the impacts of climate change on agricultural production have hampered efforts to reduce poverty and hunger (SDG 6,7) (Chilunjika & Gumede, 2021; Mugambiwa & Tirivangasi, 2017). In contrast, climate action and SDG targets can achieve multiple goals through synergies and co-benefits (Denton *et al*., 2022). In Ahmedabad, India, the Slum Networking Project has provided basic services such as water supply, sanitation, drainage, solid waste management, street lighting, and paved roads to over 100,000 slum dwellers, while also promoting low-carbon solutions such as biogas plants, solar panels, and rooftop gardens (Lamb *et al*., 2019).

Reducing greenhouse gas (GHG) emissions and implementing adaptation strategies calls for a variety of technical and policy solutions across sectors. The cost and effectiveness of such interventions have received a lot of attention in the literature (Karlsson *et al*., 2020). However, evidence suggests that placing greater emphasis on non-climate, or developmental, co-benefits can increase support for climate action measures (Amann *et al*., 2011; Barker *et al*., 2007; Walker *et al*., 2018). These co-benefits often advance multiple targets of the SDGs. Such a reframing of climate action in policy is motivated by the rising understanding that, while technically possible in the majority of countries, climate action is constrained by political issues (Kuzemko *et al*., 2016). The lack of perceived immediate benefits and high costs for those implementing the climate action (Walker *et al*., 2018), as well as technological and behavioral lock-in mechanisms, contribute to the lack of support for these political challenges (Seto *et al*., 2016). Similarly, poor governance structures and policy development, inadequate expertise and knowledge, and a lack of adequate investment (particularly since the COVID-19 pandemic) have hindered progress toward achieving the SDGs (Jiang *et al*., 2022).

Definition of co-benefits

- The term 'co-benefit' was first used in 1990 to refer to the "unintended positive side effect" (i.e., ancillary benefits) of a policy (Miyatsuka and Zusman 2010).
- According to the IPCC AR4 report, co-benefits are defined as unintended consequences of actions taken solely to reduce CO_2 emissions (IPCC 2007).
- Co-benefits are also known as multiple benefits, co- impacts, multiple impacts etc.
- For this report, we define co-benefits as the intended positive developmental benefits in addition to their primary desired objective which is direct reductions of GHG and impacts of climate change.
- In particular, co-benefits results from synergistic action between SDGs and climate action and it includes both environmental and socioeconomic benefits and hence seen as a win- win strategy aimed at addressing both climate and developmental goals.

Definition of synergy and trade offs

- Synergies refer to the combined or cooperative effects that occur when two or more actions interact in a way that produces a result greater than the sum of their individual contributions.
- A synergistic approach to designing and implementing policies related to climate change and SDGs serves to tackle these challenges simultaneously rather than separately, with a combined effect that increases the overall impact of those policies.
- Synergistic action across policy sectors or domains of practice increases efficiency in each sector/domain, while minimising risks, thereby enhancing system functionality optimality.
- Trade offs refer to as the negative effects of climate change policies/measures.
- Precisely, it refers to the negative interaction between climate change policies/measures with sustainable development.
- Responses to climate change can be planned to maximize synergies and limit trade-offs with sustainable development

Optimizing and exploiting the synergies between climate action and SDGs are essential to advancing the achievement of both developmental and global climate targets. Synergies help overcome three key inertias that still hinder progress. First, due to the siloed nature of actions on development and climate change, the multiple impacts across the various SDGs targets and mitigation and adaptation potential are difficult to account for unless there is an agreed systems map in place where impacts can be traced across the system. What results is incoherence in policies — simply pursuing one ambition or a certain set of policies targeted at achieving SDGs or climate change can offset progress made in the other. For example, without proper consideration of the synergies, a policy on safeguarding forest lands without inclusive and participatory governance of communities that depend on forests can exacerbate inequality (SDG 10) and poverty (SDG 1) in the communities, which can lead to social unrest (SDG 16) (Sovacool, 2018). Such strategies result in more harm than good, as these end up undermining the feasibility and effectiveness of the original climate action. A consequence of this is, for example, the negative spillovers that occur due to land-use restrictions imposed on protected lands, which cause populations previously depending upon the forest resources to relocate their activities to unprotected surroundings (Fuller *et al*., 2019). Policy incoherence within climate action in one country may also cause trade-offs in the SDGs, or even climate risks in another country. For example, in a bid to remove car fleets that did not meet emission standards from Europe, most vehicles were shipped to African and Asian countries. Between 2015 and 2018, developing countries received 70% of light-duty vehicles, most of which performed poorly in terms of environmental impact, safety, and quality (UNEP, 2020). Moreover, without proper consideration of the synergies between SDGs and climate action, any progress made would be unsustainable and highly sensitive to changing global and/or international political-economic systems. This is why, for example, achieving nearly 70% of the SDG targets by 2030 would entail implementing adaptation measures in urban areas such as in housing, construction, water and electricity, and sensitive land and ecosystems such as croplands, wetlands, and rivers, particularly in the vulnerable countries (Fuldauer *et al*., 2022). For example, adaptation measures undertaken by smallholder farmers in Nepal (Khanal *et al*., 2021) and Tanzania (Magesa *et al*., 2023) have been key in advancing SDGs 1 (No poverty) and 2 (No hunger). Furthermore, countries have a greater chance of reaching their climate targets if all relevant dimensions, especially social dimensions, are integrated into the design and early planning stages. Under the Climate Promise, 96% of countries integrated gender equality considerations at various levels in their updated NDCs. These countries that integrated concrete measures or targets and developed integrated frameworks for policy coherence have been moving faster toward the implementation of such commitments (Data Futures Platform, n.d.). An understanding and assessment of the trade-offs between climate action and certain SDGs can help avoid any adverse impacts and allow policymakers to make more informed decisions about climate

and developmental objectives (Bhardwaj *et al*., 2019; B. Cohen *et al*., 2019). Indeed, there is increasing evidence of strong interlinkages, both positive (co-benefits, see Table 1) and negative (trade-offs), between climate action and the SDGs (Balouktsi, 2019; Fuso Nerini *et al*., 2019) and among SDGs, where positive correlations have been found to largely outweigh the negative ones for most countries, with at least 40% of the interactions between SDGs resulting in synergies between each other (Pradhan *et al*., 2017).

Secondly, investment gaps can be significantly reduced if development and climate targets are pursued together. The co-benefits of climate action measures and delivering SDGs can be used as a negotiating tool to secure funding for options that promise the highest net societal and environmental benefits. Targeting co-benefits to identify synergies between climate action and SDGs can increase the efficiency and cost-effectiveness of interventions (Karlsson *et al*., 2020; Ürge-Vorsatz *et al*., 2014). Finally, they also serve as a foundation for balancing short- and long-term benefits and gaining stakeholder support (Zhenmin & Espinosa, 2019). By connecting multiple issues, multi-stakeholder coalitions can be established within and beyond governments, overcoming vested interests, and breaking lock-ins.

Therefore, a comprehensive strategy that considers both synergies and trade-offs among ecological vulnerabilities and developmental requirements is needed when making decisions about climate change, especially in countries of the Global South, as it is increasingly recognized that SDGs cannot be advanced without concurrent action on climate change mitigation and adaptation. These requirements and vulnerabilities can be addressed across a range of spatial and temporal scales and adapted to local contexts using the co-benefits approach to climate change actions and SDGs, which seeks synergistic outcomes that meet multiple objectives (Karlsson *et al*., 2020; Spencer *et al*., 2017).

TABLE ES-1. Example of co-benefits between climate action and SDGs from modelling studies and practices in the real world.

Country	Climate policy/program	Co-benefits	Focus SDG	Reference
New Zealand	Model Communities Programme, an active travel intervention program to encourage walking and cycling	• Annual benefits for health in the intervention cities were estimated at 34.4 disability-adjusted life years (DALYs). • Lives saved due to reductions in cardiac disease, diabetes, cancer, and respiratory disease.	3	Chapman *et al*., 2018
USA, Turkey, Germany, India, China, and Brazil	Leadership in Energy and Environmental Design (LEED) certification of buildings, a green building certification program	• Saved USD 7.5B in energy costs. • Averted 33MT of CO_2, 51 kt of SO_2, 38 kt of NOx, and 10 kt of $PM_{2.5}$ from entering the atmosphere, amounting to USD 5.8B (lower limit = USD 2.3B, upper limit = USD 9.1B) in climate and health co-benefits from 2000 to 2016.	3, 7, 11, 13	MacNaughton *et al*., 2018

Country	Climate policy/program	Co-benefits	Focus SDG	Reference
UK	'Boilers on Prescription', a project that allows family doctors to 'prescribe' double glazing and loft insulation for patients living in cold, damp homes	• 6-month health household savings of £94.79 per household. • ≥65 age group experienced significant improvements in health status and anxiety. • Levels of happiness and life satisfaction were slightly above UK norms, and mental wellbeing results were relatively high. • 60% reduction in the number of GP appointments. • Accident and Emergency attendance reduced by 30%. • Investing £1 in keeping homes warm is estimated to save the NHS £0.42 pence in direct health costs.	3, 8, 11	Bray *et al*., 2017; Jennings *et al*., 2019
Cairo, Lagos, Johannesburg, Accra	Air pollution control measures, such as upgrading public transport and cleaner cookstoves*	• Raise a total of USD 20.4B between 2023–2040 in the four cities. • Prevent a total of 126,000 premature deaths across the four cities between 2023–2040. • Reduce GHG emissions by up to 20% by 2040 (avoiding over 0.47 Gt CO_2e).	3, 8, 13	lean Air Fund, 2022a
Casamance Natural Subregion (Senegal, Gambia, Guinea Bissau), Western Africa	Access to clean cooking solutions*	• SDG 5 represented 60–97% of the total economic benefits. • 0.5 t of CO_2e reduction in GHG emissions per person. • Health co-benefits (SDG 3) represented <1% of the total economic benefits. • Annual economic benefits were €316.03 and €159.31 in Senegal, €334.84 and €144.50 in the Gambia, and €192.58 and €96.55 in Guinea Bissau, for 100% and 50% time saved in collected fuelwood respectively.	3, 5, 7	Mazorra *et al*., 2020
Southeast Asia	Forest carbon projects*	• Avoid 835 MtCO_2e of emissions per year from deforestation. • Support dietary needs for an equivalent of 323,739 people annually from pollinator-dependent agriculture. • Retain 78% of the volume of nitrogen pollutants in watersheds yearly. • Safeguard 25 Mha of Key Biodiversity Areas.	2, 6, 13, 15	Sarira *et al*., 2022

Country	Climate policy/program	Co-benefits	Focus SDG	Reference
Kenya	Blue carbon projects (Mikoko Pamoja and Vanga Blue Projects)	*Mikoko Pamoja* • Protection of 107 ha of natural mangrove forests and conserve 10 ha of red mangrove plantations. • Annual revenue of USD 130,000 for coastal villagers. • Revenues raised used to fund water pumps for schools and a community of over 5,000 people, and financed the purchase of textbooks, sports uniforms, and other learning materials for 700 children. *Vanga Blue* • Protection of 460 ha of mangroves. • Sink for 9,000 t of carbon. • Support the livelihoods of 9,000 people.	1, 6, 8, 10, 13, 15	Association for Coastal Ecosystem Services, n.d.; Huff & Tonui, 2017; Kanhema, 2023
Germany and Hungary	Energy-efficient buildings*	• A German worker can gain 5.2 productive days a year, while a Hungarian 2.2 days by avoiding sick days. • Monetary equivalent of the total number of days gained would be as high as €337 million and €7 million/ year from the residential building sector, and €398 million and €3 million/ year from the tertiary building sector for Germany and Hungary respectively. • The German and Hungarian workforce can gain €95 and €2 million respectively each year by improving work performance from working in high-efficiency tertiary buildings. • Both Germany and Hungary can gain 1,870 and 3,849 healthy life years/ million population which is equivalent to €277 and €134 million per year respectively.	1, 3, 7, 8, 11, 12	Chatterjee & Ürge-Vorsatz, 2021

Country	Climate policy/program	Co-benefits	Focus SDG	Reference
European Union (EU)	Energy efficiency measures*	• 1) Avoided emissions of 362 Gt CO_2e per year. 2) For $PM_{2.5}$ reductions. • Yearly losses of more than 10,000 DALY and 230,000 years of life lost (YOLL) can be avoided every year. • The total EU material footprint can be reduced by over 850 Mt per year of material resources. • Up to 24,000 premature deaths and 22,300 DALYs could be avoided annually. • Economic impacts are substantial: up to 1% increase in GDP and 2.3 million job-years could be stimulated. • Energy prices may decrease 1–3% below the reference scenario, amounting to around 50–70% of energy cost savings.	1, 3, 7, 8, 9, 11, 12, 13	Thema *et al*., 2019
Pakistan	Air pollution control measures*	• SO_2, NO_x, and $PM_{2.5}$ emissions would decrease by 64%, 56%, and 56% in 2050 compared to 2015. • PM2.5 concentrations would drop to 45 µg/m^3 by 2050, compared to 93 µg/m^3 (a 51% reduction) in the baseline projection. • Mortalities fall by 24% to 159163 in 2050, compared to 208236 in the baseline estimate. • 64% lower CO_2 emissions in 2050 than the baseline case.	3, 7, 11, 13	Mir *et al*., 2022
Tanzania, Ethiopia, Malawi	Women's empowerment: improving resilience, income, and food security	• 32% increase in women's access to food (Ethiopia). • 37% increase in women's empowerment index score and 56% increase in household decision-making (Tanzania). • Household asset values increased by 42% in Ethiopia, 31% in Malawi and 26% in Tanzania. 166% increase in productivity (Tanzania). • Increases in women's leadership, in access to savings and credit, in access to extension services, and in use of organic inputs.	1, 2, 5, 10, 12, 13, 15	TANGO International, 2017

Country	Climate policy/program	Co-benefits	Focus SDG	Reference
93 Global South Countries	Clean energy access/ transition: Women's entrepreneurship and climate leadership at the local level	• 3,500 rural women trained in renewable energy technology and micro-entrepreneurship alongside enterprise skills, financial inclusion, and health. • More than 2.5 million people now have access to light.	1, 5, 7, 8, 10, 12, 13	(Barefoot College International, n.d.)

* modelling studies.

2.1.2 Quantification and monetization

Some of the co-benefits of climate action can be directly associated with advancing SDGs, although they are rarely realized as such. Co-benefits (as well as trade-offs) exist, for example, in land-use-related mitigation policies that focus on increasing carbon stocks, conserving biodiversity, designing roads to be friendly towards active modes of transport (such as walking and cycling), creating green spaces, and ensuring food security. Solely focusing on achieving climate targets can result in 84 million more people being at risk of going hungry by 2050 in a 2°C consistent scenario (Fujimori *et al*., 2018), thus impeding progress on SDG 2. Alternately, inclusive climate policies in the form of international aid, bioenergy taxes, or domestic revenue reallocation can avert the overall cost of addressing climate change in terms of global welfare (a 3.7% loss) and rather result in a 0.1% gain, at the expense of 0.5% decrease in GDP of high-income countries used to cover the financial expenses of providing international aid (Fujimori *et al*., 2018). Similarly, decarbonization of energy supply systems and universal energy access also display co-benefits and trade-offs. Achieving universal electricity access across sub-Saharan Africa by 2030 (SDG 7) would require an annual investment of USD 27 billion under existing climate policies, but would require an additional USD 6 billion without climate policies (Dagnachew *et al*., 2018). The co-benefits between emissions reduction and investment savings are largely driven by the energy efficiency measures for household appliances, which can lower costs by 20% (Dagnachew *et al*., 2018).

When trade-offs between social SDGs and climate and environmental SDGs are not considered, social programs may fail to deliver the intended outcomes on targeted policy areas. For example, a shift to a low-carbon (SDG 13) and resource efficient economy (SDG 12) could generate 100 million jobs globally by 2030 but also put at risk nearly 80 million jobs (ILO, 2019). Synergistic policies on education, training, skilling, and life-long learning (SDG 4) and social protection (SDG 1) can enable smooth transitions in labor markets and mobility across economic sectors and occupations. The ILO (2019) estimates that of the 78 million workers whose jobs might be eliminated in the shift to a green economy, most will be able to find jobs in the same occupation in another industry within the same country through reallocation. Similarly, the Zero Hunger social protection program in Brazil was not only unable to successfully alleviate child malnutrition or infant mortality but higher investment resulted in vegetation losses (Dyngeland *et al*., 2020). Without considering climate action under SDG 13 and their impacts on SDG 15, these social protection programs did not have the intended consequences on the social SDGs targeted (SDGs 1–3). Indeed, SDG 13 is often viewed (arguably incorrectly) as one of the most antagonistic SDGs, such as with SDG 9 and 11, which could hinder progress made in additional SDGs (Kroll *et al*., 2019). However, with climate mitigation

policies targeting climate-friendly infrastructure, low or zero-emissions transport systems, and low-carbon energy-efficient industries any such trade-offs are increasingly being diminished. Moreover, in general, near-term adaptation and mitigation efforts have more co-benefits than trade-offs with SDGs, as illustrated in Figure A1. Therefore, climate action and policies impact across a wide-range of SDGs — dedicating a standalone SDG to climate action often fails to account for these interactions, which is where there is a crucial need for a different, and integrated governance framework.

The co-benefits of climate action that dominate the literature is improved air quality (addressed through SDGs 3 & 11) although research from some geographical areas also pays attention to food (SDG 2), exercise (SDG 3), soil (SDG 15) water quality (SDG 6), biodiversity (SDG 15), economic performance (SDG 8), and energy security (SDG 7) (Karlsson *et al*., 2020). Co-benefits are demonstrated to be of significant economic value, with air quality improvements frequently being of the same or even greater order of magnitude than mitigation expenditures. Generally, there is a wide variety of estimates for the air quality co-benefits of addressing climate change, ranging from USD 2–196/tCO_2 with a mean of USD 49/tCO_2, with the biggest co-benefits seen in the Global South as a result of a large population still relying on unsustainable energy sources such as fuelwood (Nemet *et al*., 2010). These co-benefits are generally experienced in the form of health benefits.

For example, one study found that stringent air pollution control and GHG mitigation measures would help bring 40% of the global population exposed to particulate matter levels below the WHO air quality guideline, with the largest improvements realized for India, China, and the Middle East (Rao *et al*., 2016). This would significantly advance SDG targets 3.9.1, 7.1.2, and 11.6.2, which would otherwise likely not be met under current policies (Rafaj *et al*., 2018). Generally, the health benefit to mitigation cost-benefit ratio ranged from 1.4–2.45 depending on the scenario (Markandya *et al*., 2018). For China and India, the health co-benefits alone could cover the costs of lowering GHG emissions, with greater variation in cost-benefit of the European Union (7–84%) and the United States (10–41%), which were, nonetheless, still significant (Markandya *et al*., 2018). Moreover, the additional effort required to pursue the 1.5°C goal rather than the 2°C target would result in a sizable net benefit for China (USD 0.27–2.31 trillion) and India (USD 3.28–8.4 trillion), but not as much for other regions (Markandya *et al*., 2018). Another study demonstrated how the energy system transition pledged under the Paris Agreement (NDCs) can significantly reduce global air pollution and avert between 71–99 thousand premature deaths annually in 2030 depending on the stringency of air pollution control measures, or by as much as 178–346 thousand annually in 2030 under a more ambitious 2°C compliant pathway (Vandyck *et al*., 2018). Moreover, the co-benefits related to health and agricultural productivity were found to globally offset the costs of climate policy and contribute to increased global GDP. At the national level, an annual decline in 11.8 million air pollution-related deaths, 5.86 million diet-related deaths, and 1.15 million fatalities from physical inactivity by 2040 could be experienced under NDC and related policies in Brazil, China, Germany, India, Indonesia, Nigeria, South Africa, the UK, and the USA (Hamilton *et al*., 2021).

In addition to decarbonization, another crucial step towards meeting the 1.5°C goal is reforming global energy consumption patterns. This, of course, must happen in line with the existing contexts, as millions still do not have adequate access to affordable, reliable, sustainable, and modern sources of energy. For example, a study projected a 40% reduction in global final energy demand by 2050, based on existing observable trends in low energy demand, despite rises in population, and economic activity and growth

(Grübler *et al*., 2018). Decisions about pathways to meet energy demand can have an impact on the greater welfare and wellbeing of people, the resilience and effectiveness of physical and social infrastructures, and the health of the natural environment (Fuso Nerini *et al*., 2018), and must therefore be made in a way that is just and sustainable. Demand-side mitigation options targeting technology choices, consumption, behavior, lifestyles, coupled production-consumption infrastructures and systems, service provision, and associated socio-technical transitions are increasingly receiving attention in the literature (Creutzig *et al*., 2018, 2022; Mundaca *et al*., 2019). However, there is a lack of a uniform assessment of both their general potential and societal ramifications, which has contributed to the lack of policy attention on interventions focusing on curbing demand-side emissions. Overall however, these have the potential to reduce sectoral emissions by 40–80% in end-use sectors, while offering significant co-benefits (about 80%) through improvements in wellbeing by delivering across the SDGs (Creutzig *et al*., 2022). One such measure that has received considerable attention is the implementation of energy efficiency measures. Globally, increases in energy efficiency across many sectors have prevented over 200 Mt of energy-related GHG emissions in 2019 (IEA, 2020). Energy efficiency measures also deliver co-benefits that contribute to various SDGs, including improved health, wellbeing, and productivity, the generation of jobs, greater energy security, and reduced resource depletion (Chatterjee *et al*., 2022). Upgrading old buildings to be more energy-efficient is a common strategy used by cities to reduce GHG emissions. In the years leading up to 2050, 2 million net jobs may be produced annually (SDG 8) by investing in building upgrades in OECD cities (Gouldson *et al*., 2018). The same level of investments in non-OECD cities may generate between 2–16 million net new jobs annually over the same timeframe. In addition to creating jobs, improved working conditions and a decline in illness rates make employees in energy-efficient buildings 1–16% more productive (SDGs 3, 8) thus increasing GDP growth (Gouldson *et al*., 2018). Another important recipient sector of energy efficiency measures is transport, where countries have sought to shift to battery-powered electric vehicles (Chatterjee *et al*., 2022). The transport sector is particularly useful in demonstrating synergies between emission reduction and other SDGs, such as through improved physical activity, reduced injuries and health risks, improved air quality, and reduced heat vulnerabilities, among others, such as adopting active transport modes (WHO, 2011). For example, a modelling study integrating scenarios with high uptake of low-carbon vehicles in the Ahmedabad city of India alone can reduce 74% of NO_x and 83% of $PM_{2.5}$ from the passenger transport sector compared to business-as-usual in 2035 (Pathak & Shukla, 2016). Moreover, actions to implement the Paris Agreement through a rapid shift to renewable energies, improvements in energy efficiency, and scaling up of the use of electric vehicles has the potential to generate 24 million jobs by 2030 (ILO, 2018). Thus, by committing to emission offsetting through improvements in energy efficiency, cities not only aid the worldwide effort to combat climate change, but may also profit locally by realizing several associated advantages.

2.1.3 Methodologies

Generally, researchers have sought to conduct interaction mapping between individual SDGs, or SDGs and climate activities, using content analysis, network analysis, correlation analysis, or surveys and expert elicitations (Bie *et al*., 2023; Brandi *et al*., 2017; Coenen *et al*., 2022; Huan *et al*., 2023; Iacobuţă *et al*., 2021; Kostetckaia & Hametner, 2022; Pradhan *et al*., 2017; Stevenson *et al*., 2021; Urban & Hametner, 2022). However, policy actions on climate change and individual SDGs tend to operate in silos, and most fail to account for any potential co-benefits and trade-offs. Such a failure to capture the complete picture of policy impacts can not only result in ineffective policies and goal failures but may also impede the uptake

Addressing trade-offs of climate action for a just transition

If not properly planned, climate action can have adverse impacts on some of the progress made in achieving the SDGs, particularly those socially focused. This is why the social SDGs (e.g., 1, 5, 10) are largely underrepresented in NDCs (Dzebo *et al*., 2023). Climate measures may be socially and economically regressive, worsening poverty and inequality (SDG 1) for example, by affecting the cost of food and land (SDG 1, 2), and raising the possibility of leaving small agricultural producers behind (SDG 2). In Bangladesh, the National Adaptation Program of Action, primarily aimed at climate mitigation and adaptation, allowed elites to take hold of village properties, public lands, forests, farms, and other public commons, perpetuating poverty and powerlessness, and exacerbating instability and inequality (Sovacool, 2018). Similarly, the creation of urban green spaces, while offering advantages to city dwellers and increasing vegetation coverage in cities to serve as carbon sinks, may run the risk of contributing to gentrification in nearby communities by driving up housing prices and upscaling real estate projects, and drive out marginalized and low-income households from those areas (Matthew McConnachie & Shackleton, 2010; Wu & G. Rowe, 2022; Zérah, 2007).

Similarly, investment in low carbon technologies may also pose some risks, such as resource depletion of critical minerals (SDGs 11 and 12), and adverse impacts on ecosystems (SDGs 6 and 15). For example, the demand for cobalt, lithium and nickel is expected to see significant growth due to their use in batteries in the rapidly growing electric vehicle market. However, most of the extraction and processing is done in the Global South, most notably in the Democratic Republic of the Congo, which provides 70% of the global cobalt production (Beales *et al*., 2021). Cobalt miners work under poor conditions with tremendous safety and health risks (SDGs 3 and 16), and there is a tendency to employ child labor workers (SDGs 8 and 16) (Beales *et al*., 2021).

Climate change might also have a negative impact on millions of people who work in the fossil fuel industry and their dependent communities. However, these can be mitigated through policies that consider both costs and benefits, and thus ensure a just transition. According to the 111th International Labour Conference 2023, a just transition promotes environmentally sustainable economies in a way that is inclusive, by creating decent work opportunities, reducing inequality and by leaving no one behind. Therefore, creating enabling environments for job substitution can be one solution. In Argentina, due to the promotion of agrofuels, the relatively labor-intensive citrus industry was effectively replaced by soybean, a less labor-intensive and more land-extensive commodity (Rosemberg, 2010). This effectively redirected employment opportunities to a less harmful sector, while simultaneously promoting advances in SDGs 2, 8, and 15, among others. Similarly, for countries moving away from a carbon intensive energy sector, workers in the offshore oil industry could potentially be re-employed in the offshore renewable industry (Esteban *et al*., 2011).

Moreover, although climate actions could support the use of efficient and renewable energy (SDG 7), they could also impact the provision of accessible, dependable, and sustainable energy services for all by 2030, as fossil-based fuels can be more economical in some energy-insecure regions (Nerini *et al*., 2016). For example, hydroelectric power plants are often major investments under the Clean Development Mechanism, especially in Asian and African countries as a strategy to shift away from high carbon power sources. However, such projects are often accompanied by numerous environmental and social damages, such as the alteration of water ecology and supplies and fisheries (SDGs 14 and 15), which impact the local communities' rights to food (SDG 2) and water (SDG 6) and impacts their livelihoods (SDGs 8 and 10) (Siciliano & Urban, 2017). Nevertheless, renewable energy sources have been deployed in many impoverished, marginalized, and fragile communities, especially those that are remote. LPG gas stoves have been widely distributed in the Rohingya refugee camps in Bangladesh to not only alleviate pressure on nearby forests (SDGs 13, 15), but also to offer communities with a cleaner and healthier energy source for cooking (SDG 7) (Rafa *et al*., 2022).

Overall, some SDGs will continue to have trade-offs, especially SDGs 11, 13, 14, 16, and 17, as well as non-associations with other SDGs, which can impede the adoption of a synergistic approach (Kroll *et al*., 2019). Therefore, complementary policies need to be designed that mitigate the impacts of some of these trade-offs to ensure a just transition. Nevertheless, while consideration of SDGs are crucial for selecting socially acceptable carbon mitigation pathways, lack of ambition in carbon policies would result in lower prospects of reaching other SDGs (Von Stechow *et al*., 2016).

of such policies, resulting in the very evident lag in the progress made in both the SDGs and climate agendas. To promote systematic analysis and more reliable comparisons, several authors have proposed categorizing the co-benefits and trade-offs (Baumber *et al*., 2019; Raymond *et al*., 2017; Ürge-Vorsatz *et al*., 2014). However, it is still difficult to consistently quantify co-benefits and to analyze, present, and use the information (B. Cohen *et al*., 2019; Karlsson *et al*., 2020; Mayrhofer & Gupta, 2016; Ürge-Vorsatz *et al*., 2014).

Most of the studies that have attempted to quantify the magnitude of co-benefits are model based. Some of the most commonly used models used are the Global Change Assessment Model (GCAM) (Chaturvedi & Shukla, 2014; Markandya *et al*., 2018), Greenhouse Gas and Air Pollution Interactions and Synergies (GAINS) (Hamilton *et al*., 2021; Mir *et al*., 2022; Rao *et al*., 2016; Vandyck *et al*., 2018), Asia-Pacific Integrated Model (AIM) (Fujimori *et al*., 2020; Liu *et al*., 2019; Matsumoto *et al*., 2019; Mittal *et al*., 2015), Model for Energy Supply Strategy Alternatives and their General Environmental Impact (MESSAGE) (Selvakkumaran & Limmeechokchai, 2013; van Vliet *et al*., 2012), and other integrated assessment models (IAM). These are often linked to an air quality model (such as TM5-FASST), using scenarios described under Representative Concentration Pathways (RCPs) and/or Shared Socioeconomic Pathways (SSPs). Cost-benefit analysis is also frequently employed in the development of climate policies (van den Bergh, 2017). Quantitative results are often presented in terms of the magnitude of averted deaths, as percentages of mitigation costs, or the cost per tonne of CO_2e (Karlsson *et al*., 2020). Such variances between methodologies can slow down policy-relevant comparisons of monetary values. Nevertheless, as carbon taxes and mitigation costs are frequently represented in terms of USD/tCO_2e, this metric is also appropriate for measuring the value of co-benefits (Remais *et al*., 2014). This has been applied to air quality, as demonstrated, but far less frequently to other categories. Making decisions might be aided by conducting financial valuations across more categories and presenting the results in equivalent terms, such as USD/tCO_2e (Karlsson *et al*., 2020).

Initially, models focused on hypothetical policies in Global North countries such as carbon taxes and emissions trading schemes (Ekins, 1996). However, studies began to show that the estimated sizes of the local development benefits (often cleaner air and better health) tended to be larger in countries of the Global South. This was, in part, due to higher levels of air pollution and denser populations that meant that the same kinds of interventions in such countries would have a greater impact on air quality and health (Nemet *et al*., 2010).

These methods have been able to demonstrate synergies that exist between climate action and advancing SDG targets within empirical work. However, they are often associated with various assumptions, estimations, and uncertainties, which can result in variations in the costs and benefits across sectors and geographies. They are also unable to fully capture all the potential co-benefits (or trade-offs), especially social ones which are often difficult to quantify and monetize. Nevertheless, these methods have been indispensable in identifying synergies between climate action and policies aimed at advancing SDGs more accurately. However, the interface between modelling and action is still limited due to a weak science-policy-society interface. To assist academics and policymakers in developing actionable priorities, these modelling tools must be improved and made more widely accessible to policymakers, particularly in those areas involving the major drivers and trends that will decide future sustainability and have significant socioeconomic ramifications, such as energy consumption, food and water security, and increased urbanization.

2.2. The Evidence

2.2.1. Synergies in practice: NDC-SDG linkages and LT-LEDS

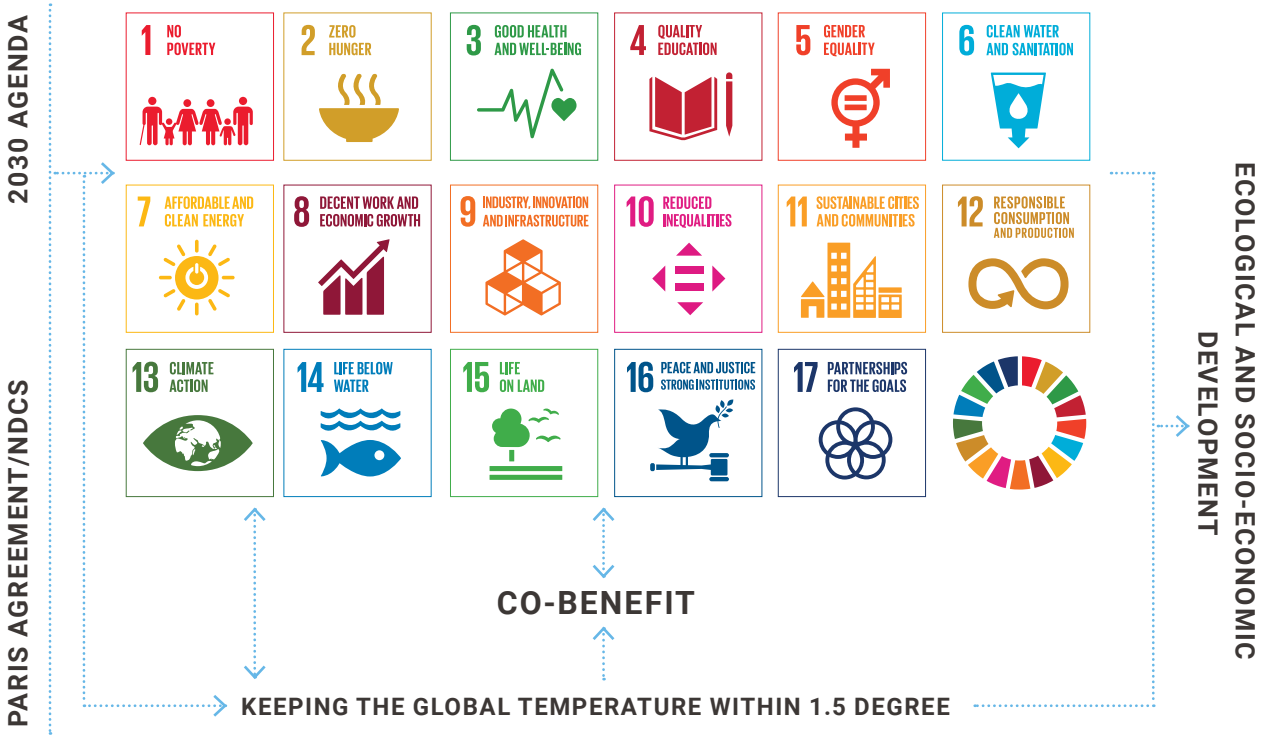
The overwhelming focus on co-benefits between either developmental goals or climate action has meant that any expected synergies between development and climate have failed to be realized. The preconceptions and biases of recipient audiences significantly affect the way in which data are processed by decision-makers and other stakeholders (Bernauer & McGrath, 2016; Walker *et al*., 2018) and choices and policies about climate change and sustainable development are often made in silos on national and international levels. There is mounting evidence that addressing climate change requires a transformation that considers all aspects of sustainability. Similarly, achieving the 17 SDGs of the 2030 Agenda demands substantial action on climate change (Campagnolo & Davide, 2019; Moreno *et al*., 2023). Therefore, there has been a strong urge to exploit the synergies between the Paris Agreement and the 2030 Agenda by carefully exploring their interactions and mitigating any associated trade-offs (Gomez-Echeverri, 2018). Consequently, alternative framings have been recommended in which climate change actions and developmental progress are considered simultaneously when evaluating policy decisions (Bhardwaj *et al*., 2019; Mayrhofer & Gupta, 2016; Ürge-Vorsatz *et al*., 2014). In addition to increasing the likelihood of successfully achieving both agendas, such a synergistic approach will also result in a more efficient allocation of financial resources (Iacobuţă *et al*., 2022) as a lack of financing across climate and developmental objectives remains a major challenge. Indeed, the governance framework for sustainable development has arguably entered an 'era of synergies' (Visseren-Hamakers, 2015), where the density and complexity of multilateral environmental agreements and other international institutions have grown, leading to an increased focus on how these institutions interact with one another and the governance framework as a whole (Zelli & Asselt, 2013).

One way to approach the Paris Agreement and the 2030 Agenda synergistically is to assess any overlaps between NDCs and SDGs (refer to Figure 1 for the conceptual framework of a synergistic approach). For example, Colombia, Uganda, and Burkina Faso all refer to the SDGs in their NDCs (NDC Partnership, 2022). Kenya and Mexico are two of the few countries that considered the SDGs when selecting and formulating their NDCs (Bouyé *et al*., 2018). In Kenya, the Climate Change Department of the Ministry of Environment and Forestry conducted an SDG impact analysis of the proposed measures of the National Climate Change Action Plan (NCCAP) (2018–2022). This analysis helped capture SDG-climate synergies and identify opportunities for low-carbon development in the country. Moreover, the Kenyan government aligned the planning cycles for reaching the goals and strategies of its NDC, National Development Plan, and national SDG action plans through a combination of top-down and bottom-up approaches (SIDA, 2017). Similarly, Mexico has evaluated how existing NDCs would affect the implementation of the 2030 Agenda nationally, with the ambition of undertaking integrated policy approaches to advancing SDGs and NDCs (Bouyé *et al*., 2018). All 169 SDG targets were examined for potential connections to measures for climate mitigation and adaptation. Sixty-four of the targets were found to have potential co-benefits to climate mitigation and adaptation. Moreover, under the Climate Promise, 33% of countries made the link between SDGs and NDCs, mainly related to gender equality, while 18% of submitted NDCs assessed mitigation and adaptation measures against SDGs and pinpointed those contributing to SDG 5 on gender equality (UNDP, 2021b). The NDCs of Antigua and Barbuda make a clear connection between climate action and the SDGs. For example, the NDC prioritizes addressing energy poverty because of the disproportionate effect it has on women and girls when addressing gender inequities. In addition to providing gender-responsive targets under mitigation and adaptation to support efforts to ensure that everyone has access

to energy, it pledges to mainstream gender in its energy planning through an inclusive renewable energy policy. There have also been efforts to make connections between climate and other development needs in the VNRs that countries share to outline their progress and plans on the SDGs. Illustrative examples include Mongolia's VNR which demonstrates a commitment to addressing air pollution, climate change, and health concerns through an integrated approach (Mongolia Voluntary National Review, 2019).

There have also been significant signs of progress to leverage synergies at local levels. Table A1 illustrates some case studies across the world that have sought to utilize synergies to simultaneously accomplish climate targets and SDGs. At the national level, significant progress has been made to integrate the two goals. Colombia, for example, has adopted vertical coordination to implement both agendas (Bouyé *et al*., 2018). The SDGs and the Paris Agreement are included in local planning and budgeting through collaboration between the federal and local governments. This NDC localization approach is founded on an analysis of how development goals from 2016 to 2019 align with the SDGs that revealed that around one-third of these plans do not address the key national priorities for combating climate change. Colombia divided the nation into nine regional nodes to enhance vertical (and horizontal) policy coherence and establish uniform and local integration with appropriate burden sharing. Colombia's updated NDC (Teebken *et al*., 2021) identifies synergies with the 2030 Agenda in the areas of poverty eradication, food security, gender equality, and biodiversity protection. Cities in Japan are increasingly making the links between climate and the SDGs. For example, Kyoto's climate action plan reflects these linkages. Several Japanese cities are also actively promoting an approach known as 'regional circulating and ecological sphere' aimed at integrating climate change, biodiversity, and circular economy goals by harmonizing resource flows

FIGURE 1. How a synergistic approach to addressing the Paris Agreement and 2030 Agenda achieves developmental and climate co-benefits.



between rural and urban areas (Takeuchi *et al*., 2019). For example, Sado recently passed a local ordinance on the circulating and ecological sphere and is aiming to become a carbon-free island by 2050. A similar approach is gaining attention in other parts of Asia such as Udon Thani, Thailand, and Nagpur, India (Thapa *et al*., 2020). Other local governments are also spearheading efforts to make links between climate and core development needs: Quezon, Philippines has put forward an ambitious climate goal that requires investments in clean energy and nature-positive green spaces (Enhanced Local Climate Action Plan, 2021). Similarly, France views municipal governments as crucial players in the implementation of both agendas with local governments involved in the national coordination of both agendas via the French National Council for the Ecological Transition (Bouyé *et al*., 2018). Representatives from cities, unions, businesses, NGOs, associations, and the parliament make up the National Council which discusses corporate social and environmental responsibility, energy policy, sustainable development, biodiversity policy, and climate change policy. The National Council has recently helped to advance integrated strategies for addressing climate change, air pollution, and mobility. The advantage of connecting the NDCs to the SDGs is that it highlights the co-benefits of taking action on climate change, which may result in a greater willingness among line ministries to undertake climate action (Bouyé *et al*., 2018). In some instances (*e.g.*, Bangladesh and Indonesia) the SDG framework is used as a reference point to implement NDCs (Bouyé *et al*., 2018).

The efforts to leverage linkages can also be found in sectoral policies and other enabling reforms. China has been a strong advocate of a co-control policy, and this is reflected in its atmospheric pollution control law. Cambodia's recently passed Clean Air Law includes several provisions that focus on the link between climate, air pollution, and health (Malley *et al*., 2022). Meanwhile, Indonesia has supported budget tagging that calls for government agencies to reflect contributions from sector-specific budgeting lines to climate objectives.

In the past, efforts at advancing SDGs and climate action have been hampered by various emergent global crises such as wars, pandemics, natural disasters, and political disorder. For example, the COVID-19 pandemic and the recent conflict between Russia and Ukraine caused drastic disruptions in energy supply chains, investments, prices, and demand. However, such crises can appear as opportunities for a low-carbon transition, by highlighting the impact of science-based policy advice, diversification of energy sources, and the potential for rapid lifestyle and behavioral changes (Zakeri *et al*., 2022). One study, for example, found that with the right policy support, global dependence on Russian gas, oil, and coal can be slashed by over 50%, and GHG emissions can be reduced by 3% within one year (Creutzig, 2022). As such, with the appropriate kind of policy support, development trends may emerge even stronger after these crises.

An encouraging sign can be found in the COVID-related stimulus policies and programs in many countries. The United States Inflation Reduction Act frames investments in climate change as part of a larger push for sustainable economic development and places a significant emphasis on job creation (United States White House, 2021). The European Union has created a just transition mechanism designed to anticipate and facilitate the shift of laid-off fossil fuel workers into more sustainable industries (European Commission, 2020). Many Spanish local governments have used stimulus funding to advance climate action rooted in broader development aspirations (Energy Policy Tracker, 2021). However, many countries have directed these stimulus package investments to business-as-usual programs, or in some cases, reverted to previously abandoned policies, such as reopening of coal-fired power stations, thus representing a significant missed opportunity.

Currently, however, only 23 (Albania, Antigua and Barbuda, The Bahamas, Belize, Cambodia, Chile, Dominican Republic, Republic of Guinea-Bissau, Sri Lanka, Sierra Leone, Tanzania, Vietnam, Vanuatu, Zimbabwe, Saint Lucia, Rwanda, Moldova, Macedonia, Nauru, Namibia, The Federated States of Micronesia, Malawi, Lebanon) of the 173 NDCs explicitly refer to SDGs, even though they have a significant impact on achieving the SDGs at regional and global levels, and none go into detail about how climate policy affects the SDGs' accomplishments. For example, only after content analysis and expert contributions, was it found that the NDCs of West African countries are typically well-aligned with SDGs that aim to end extreme poverty (SDG 1), improve food security (SDG 2), improve access to water (SDG 6), ensure clean energy (SDG 7), combat climate change (SDG 13), and stop land degradation and deforestation (SDG 15), all of which have implications for the African Union's Agenda 2063, which aims to promote socioeconomic and political reform, guarantee inclusive growth, and promote sustainable development on the continent (Antwi-Agyei *et al*., 2018).

Nevertheless, some non-governmental bodies are developing tools for identifying connections between NDCs and SDGs. The NDC-SDG Connection tool developed by the Stockholm Environment Institute (SEI) and the German Institute of Development and Sustainability (DIE) in 2017, allows users to investigate the connections between NDC activities and the 17 SDGs and associated 169 targets, both internationally and for specific nations and country groupings (Brandi *et al*., 2017). It seeks to foster an open dialogue on how to build complementarity between the two global agendas and promote learning and partnership across countries and raise the ambition of future NDCs. Using this tool, it was revealed that, globally, there are significant overlaps between NDC climate activities and SDGs 2, 6, 7, 9, 11, 13, 15, and 17. These SDGs are also advanced the most via climate-related official development assistance (ODA) (Iacobuţă *et al*., 2022). Moreover, at the transnational level, 71 climate actions were found to generate co-benefits across 16 SDGs, with greater overlaps with SDGs 7, 9, 12, 13, and 17, with SDG 9 serving as a crucial connector between several other SDGs due to having highly synergistic action (Coenen *et al*., 2022).

From Figure 2, it is evident that few overlaps were reported between NDC activities and SDGs 1, 5, 10, and 16. However, in the updated NDC submissions there is a markedly increased focus on gender, inequality, and participation, with the number of activities having increased three-fold for SDGs 5 and 10, and fifteen-fold for SDG 16 (Dzebo *et al*., 2023). Nevertheless, there remains a stark gap between the focused alignment of climate activities with social SDGs. Countries need to work towards achieving a better balance between the two, with the greater pursuit of quantifiable activities that deliver co-benefits with SDG 1, 10, and 16 (Dzebo *et al*., 2023). At the transnational level, greater mobilization is required to develop climate action that aligns with SDGs 3, 4, and 5 (Coenen *et al*., 2022). There also needs to be greater attention assigned to resolving the trade-offs between climate change adaptation actions made in certain sectors, such as ocean and coastal ecosystems, mountain ecosystems, poverty, livelihood, sustainable development, and industrial system transitions, and SDG 5, by prioritizing gender-focused targets (Roy *et al*., 2022). Some countries have adopted assistive measures to address these trade-offs. The Ministry of the Environment and the Ministry for Women and Vulnerable Groups in Peru collaborated to create a specific gender and climate action plan that evaluates how vulnerable women are to climate change and develops gender-specific policies for all relevant NDC industries (Bouyé *et al*., 2018). Moreover, the number of NDC coordination mechanisms that incorporate national gender institutions as major partners in NDC revision and implementation is growing in Climate Promise nations, with 24% of countries recognizing these institutions as components of national climate change governance structures (UNDP, 2021b). For example, the principal agency for climate empowerment efforts in Cabo Verde is the Institute for Gender

Equality and Equity, a supporting organization for many sectoral priority interventions. The institution is in charge of outlining the needs, goals, and metrics for gender-climate mainstreaming in all sectors of business and government (UNDP, 2021b). Moreover, the SDGs that are particularly impacted by climate change (*e.g.*, 2, 6, 15) are especially important to address as the updated NDCs do not have many climate activities aligned with them (Dzebo *et al*., 2023). Finally, beyond the expected significant overlaps between climate activities and SDG 7 (17%), countries need to focus further on addressing other economic SDGs (*e.g.*, 8, 9, 11, and 12) as updated NDC climate activities related to these SDGs have not increased significantly (Dzebo *et al*., 2023). This can be particularly difficult to do for SDG 12, which has greater numbers of associated trade-offs with other SDGs (Pradhan *et al*., 2017), and has also been widely ignored in terms of governance at the transnational level of climate action (Coenen *et al*., 2022). To encourage collaboration, sharing of best practices, and inclusivity by encouraging representation of a diverse range of regions to inform contextually relevant and sensitive guidance, initiatives like the NDC Partnership — a group of nations and institutions aiming to develop the NDC in harmony with the SDGs — will be essential (Fuso Nerini *et al*., 2019).

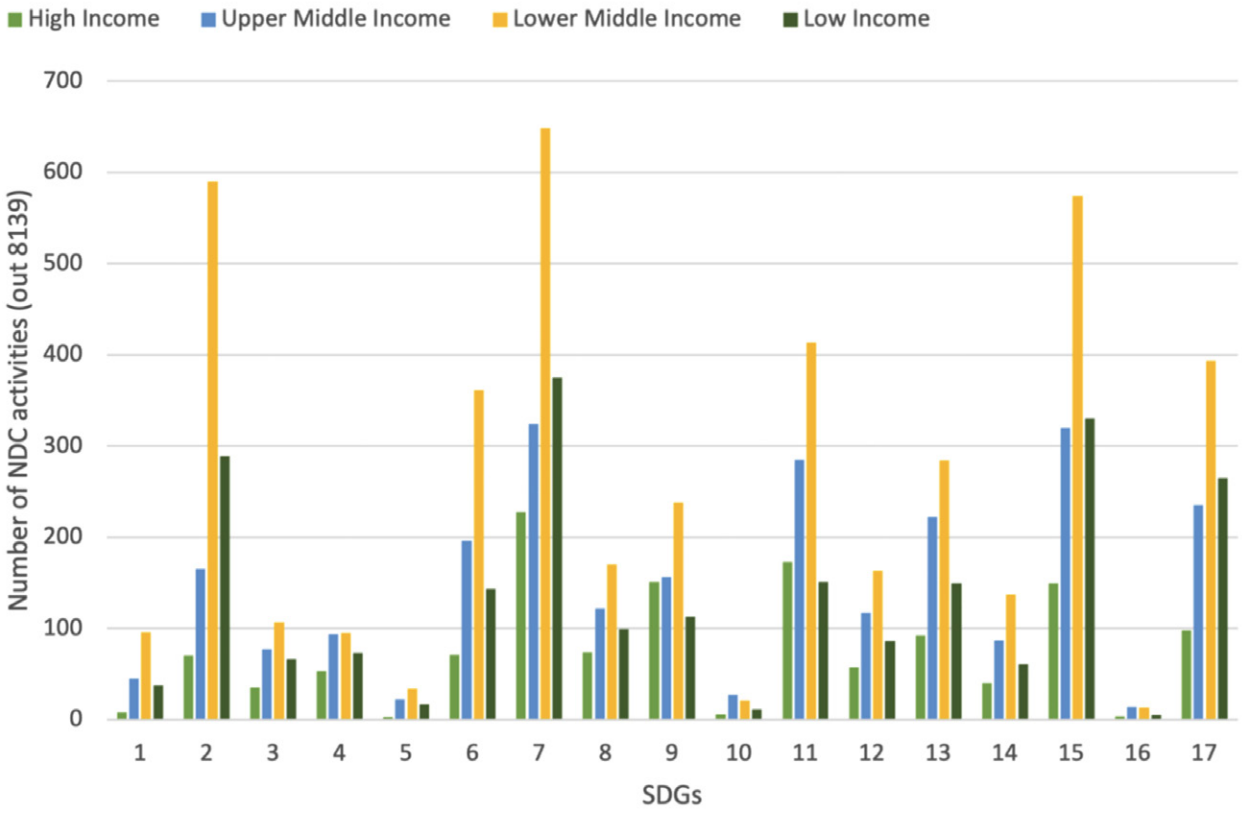
As shown in Figure 2, the overlaps between SDGs and NDC activities are more pronounced for low-income and lower-middle-income countries than for high-income countries, although for both regions, the number of NDCs that make references to SDGs is very low (a little over 200). Specifically, there are more associations between NDC activities and SDGs 2, 7, 15, and 17 for low-income countries, while, in contrast, for high-income countries, the overlaps are greater between NDC activities and SDGs 7, 9, 11, and 15. Indeed, lower, and lower middle-income countries are performing significantly better at integrating SDG objectives into NDCs. For example, the recent Global Climate and Health Alliance report demonstrated that low- and middle-income countries, such as Burundi, Côte d'Ivoire, the Democratic Republic of Congo, Dominica, the State of Palestine, and Venezuela, scored the highest for the inclusion of health in their NDCs (Global Climate & Health Alliance, 2023). On the contrary, high-income countries like Japan, New Zealand, and Australia were among the countries that failed to establish linkages with health to their NDCs (Global Climate & Health Alliance, 2023). Similarly, a 2017 analysis of 148 NDCs from developing countries illustrated that the SDGs and NDC efforts have many co-benefit policies. This was particularly evident for renewable energy proliferation (99% of NDCs from developing countries), land use, land use change, forestry (65.5%), transportation (60%), waste management (66%) and agricultural mitigation (65%) (cited in SIDA, 2017). Therefore, in such countries, climate action would have a greater impact on advancing an SDG than their high-income counterparts. On the other hand, having already attained considerable progress in their primary and prioritized SDGs, the focus for high-income countries is to meet their pledged targets under the Paris Agreement. For these countries, employing a synergetic approach to addressing the 2030 Agenda and Paris Agreement would entail using their climate action as an entry point. However, the trade-offs of climate action need to be properly evaluated and addressed so that these do not reverse the progress made in the SDGs. Due to the highly top-down, linear thinking approach to pursuing SDGs and climate objectives, high-income countries are increasingly experiencing widening inequalities in environmental justice, which often remain hidden within national averages. For instance, high deprivation areas in high-income countries have rising levels of food insecurity, often as a result of low household financial resources (Pollard & Booth, 2019). However, such issues are largely unreported in high-income countries due to a lack of routine measurement, and the use of non-comparable measures. Sub-national data are particularly important in illustrating the true inequalities that have been laid bare due to incoherent policymaking.

Following its most recent update, the NDC-SDG Connection tool now allows for a comparison of initial and updated NDC submissions, with results showing that the overlaps between the two global agendas are increasing. Updated NDCs are longer and include almost 30% more activities, including coverage of new areas. Moreover, the quality of the activities has strengthened with an increase in quantifiable and measurable activities. In addition, there has been a shift in the climate discourse with a number of key emerging themes arising in the updated NDCs that are important for sustainable development such as just transition, loss and damage, participatory approaches and social inclusion, and the green economy (Iacobuţă & Dzebo, n.d.).

Almost two-thirds of the goals have a higher number of activities in the updated NDCs with SDG 13 having the highest increase, both in total numbers and in the relative share between the first and updated NDCs (Figure 2). This is due to an increase in activities relating to climate change risks and impacts more broadly. However, specific sectors that are among the most vulnerable to climate change, such as agriculture and land-use, have seen a decrease in both the number and share of dedicated activities.

Overall, one of the most significant changes in the updated NDCs is that the social dimension of sustainable development has seen an increase in both the relative share and absolute number of NDC activities. These goals were previously identified as under-represented in countries' NDCs (Janetschek

FIGURE 2. Number of climate activities that correspond to each of the 17 SDGs across different regions.



Source: https://klimalog.idos-research.de/ndc-sdg

et al., 2020). However, despite the overall increase, the share of quantified climate activities remains low: most SDGs have less than 20% of climate activities quantified, and for most of the social SDGs there are few or no quantifiable climate activities.

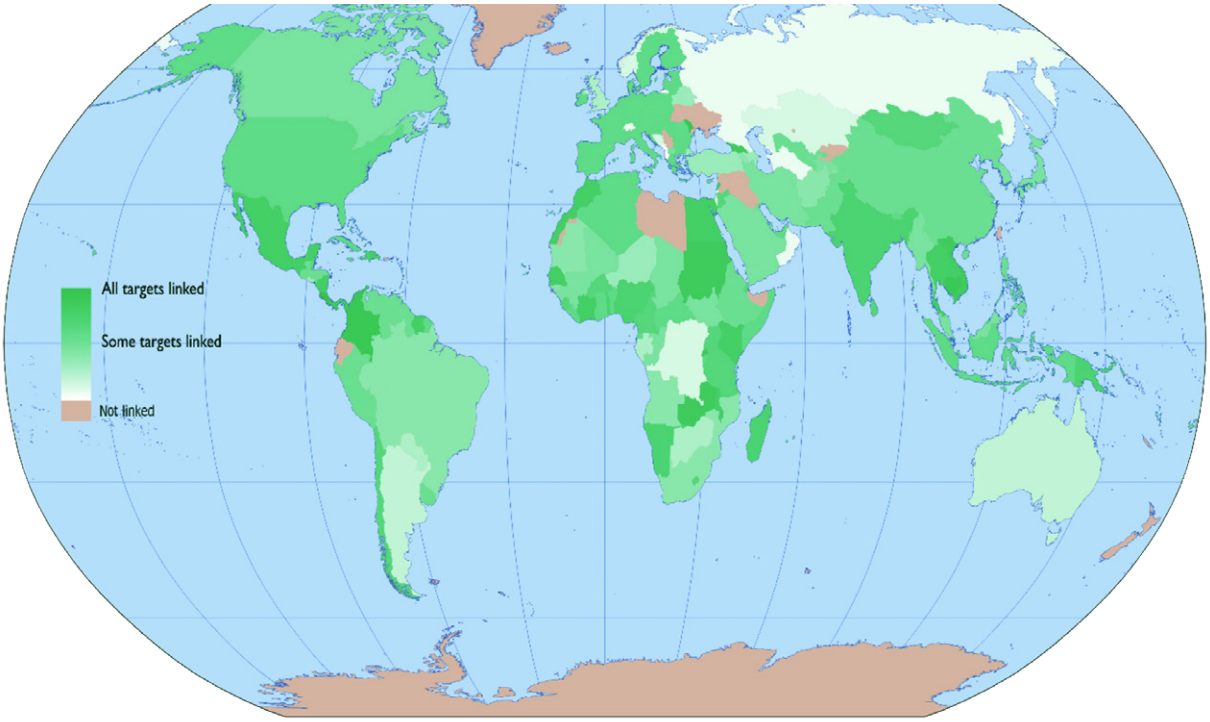
Furthermore, while key goals, such as SDG 7 are strongly prioritized, at the target level, the social dimension of energy remains a low priority. For Target 7.1 on energy access and affordability, both the share and number of relevant activities have decreased in the updated NDCs (Figure A3), even when extrapolating for particularly vulnerable countries.

The World Resources Institute (WRI) has prepared a database that allows users to explore potential alignment between the targets, actions, policy measures, and needs in countries' NDCs (submitted prior to May 2021) and the targets of the SDGs (Northrop *et al*., 2016). Figure 3 below illustrates the extent to which SDGs have been linked to NDCs across the globe. From the WRI database, we found that SDGs 1, 2, 6, 7, 9, 13, 15, and 17 have the most significant overlaps for NDCs of countries in the Global South, with SDGs 6, 7, and 13 having a greater number of linkages between the targets. This highlights the hurdles facing this region to ensure a just energy transition and water security under a highly varying climate, while also undertaking measures to combat the impacts of climate change. On the other hand, SDGs 1, 7, 8, 13, 14, and 15 have more prominent interlinkages with NDCs of countries in the Global North, with SDG 7 having a greater number of linkages. Overall, the linkages are less noticeable for countries of the Global North, because as discussed above, these countries have already attained significant progress towards SDGs and thus prioritize climate action, as featured by the dominance of SDG 7 in their NDCs. Like the SDG-NDC Connection tool, some social SDGs display fewer overlaps with the NDCs (*e.g.*, 3, 4, 5, 10, and 16).

The significant implications of climate change, which might affect 16 SDGs and 40% of the targets (Fuso Nerini *et al*., 2019), constitute a formidable argument for integrating climate action with social and economic development policies, plans, and strategies. Evidence pointing to the synergies between climate action and 80% of the targets in the 2030 Agenda highlights the opportunities of identifying and putting resources behind climate policies that have proved to generate a larger 'development dividend' (Fuso Nerini *et al*., 2019). Although there are fewer trade-offs between climate action and other SDGs (around 20% of goals), understanding the distributional effects of climate action is essential to designing comprehensive policies that leave no one behind (Fuso Nerini *et al*., 2019).

The NDC Partnership is a global coalition of countries and institutions established to develop and implement ambitious climate action that contributes to the achievement of the SDGs and the Paris Agreement. It is, therefore, a major driver for realizing the synergies between the two agendas. Importantly, member nations take the initiative to develop and carry out their own NDCs, communicating their goals and support requirements with the Partnership. Then, in accordance with their comparative advantages and in conjunction with others, Global North countries and institutions mobilize help. Publicly available implementation plans lessen the possibility of efforts being duplicated and enhance the use of scarce funding resources. Despite the fact that only 2% of the requests for NDC enhancement and implementation support made by nations through the NDC Partnership specifically reference the SDGs, 47% of the countries making requests do so in at least one request (NDC Partnership, 2022). On average, partners have agreed to fund more than half of all requests from countries made through the NDC Partnership. Considering those requests where SDGs are specifically mentioned, this average is much higher, 83% (NDC Partnership, 2022). The priority of the supporting partners to link these two agendas, as well as better flexibility or availability of development money to support SDG-linked requests, could be reflected in the higher rate of support.

FIGURE 3. Linkage of SDGs with the countries" NDCs.



Source: : https://www.climatewatchdata.org/ndcs-sdg?goal

For example, using the technical support received from the NDC Partnership, Colombia updated its NDC to increase its mitigation and adaptation targets by broadening its scope and integrating SDG sectors into climate targets. Its adaptation strategy now includes food security (SDG 2), biodiversity (SDG 15), health (SDG 3), and infrastructure (SDG 9), all vulnerable to climate change. Moreover, 16 of the 17 SDGs have been prioritized by Burkina Faso, and sectoral plans have been created for their implementation in a number of industries, including agriculture (SDG 15), the environment (SDGs 13-15), energy (SDG 7), transportation (SDGs 9 and 11), water and sanitation (SDG 6), health (SDG 3), animal production (SDG 15), infrastructure (SDG 9), gender (SDG 5), and habitat (SDG 15). In line with the goals of the 2030 Agenda's policy coherence, the new Partnership Plan seeks to integrate the NDC at all levels of government, including 20 local development plans and five regional plans.

Beyond the extrapolation of NDC-SDG linkages, countries also could draw upon the advantages of the synergies between climate and SDG action via LT-LEDS. Article 4.19 of the Paris Agreement states that nations must create and submit long-term climate strategies to be carried out through 2050. If correctly formulated and implemented, these are effectively a country's development plan until 2050. LT-LEDS help evaluate and demonstrate the socio-economic benefits of climate action and help facilitate a just transition. For example, Chile's LT-LEDS demonstrated that by merely taking energy targets into account, moving towards carbon neutrality by 2050 may result in direct economic savings of more than USD 267 billion (Government of Chile, 2021). Numerous synergies have been identified across the submitted LT-LEDS, with 91% highlighting synergies with economic growth (SDG 8), 83% with job creation (SDGs 1 & 8), 75% with

social welfare and wellbeing with reduced inequalities (SDGS 5, 10, & 16) as well as enhanced business and industry competitiveness (SDGs 8 & 9), and 72% with improved human health due to reduced air pollution (SDG 3) as well as sustainable cities (SDG 11) (UNFCCC, 2022). Moreover, more than half of the LT-LEDS have demonstrated synergies that contribute to climate resilience and disaster risk reduction (SDGs 11 & 13), sustainable consumption and production (SDG 12), infrastructure development (SDG 9), biodiversity conservation (SDG 15), improved energy security (SDG 7), and improved technology and innovation (SDG 9) (UNFCCC, 2022). Furthermore, LT-LEDS might make climate financing easier as they allow nations to properly prepare budgeting procedures to finance decarbonized development routes. This includes making it easier to receive increasingly significant international climate finance — 85% of the LT-LEDS referred to financial needs, with some identifying potential sources for implementation, such as domestic finance, international support, and private finance (UNFCCC, 2022). However, despite offering multiple opportunities to synergize climate and developmental policies, as of 2023, only 66 countries have submitted their LT-LEDS, although they represent contributors to approximately 70% of the total global GHG emissions (UNFCCC, 2022). COP28 therefore presents an important opportunity to spearhead the LT-LEDS reporting commitment of countries.

2.2.2. Operationalizing synergies

On paper, current climate targets would limit temperature rise to 1.5°C by the end of the century, however, policies currently in place to implement these targets would take us to a dangerous 2.8°C (UNEP, 2022b). Importantly, while climate targets are becoming more ambitious, emissions continue to increase as do the frequency and severity of climate impacts, with the scale of adaptation action not keeping pace to achieve climate resilience (IPCC, 2022). Therefore, the UN climate agenda needs to deliver outcomes that accelerate the translation of the potential of the Paris Agreement into action on the ground. This is essentially an issue of global and national level development. Similarly, the 2030 Agenda for Development needs to be reshaped to incorporate long-term emission reduction goals and adaptation indicators across sectors. There also needs to be a clear mechanism for justice and support for those affected by the impacts of climate change, and a clear alignment of renewable energy and energy efficiency targets in line with the Paris Agreement.

However, while the connections between the two agendas are strengthening, they continue to take place on an ad-hoc basis as there are no formal mechanisms for countries to assess the interactions, especially since the stakeholders involved in NDCs, NAPs, LT-LEDS, and VNRs are often different. The future NDCs, LT-LEDS, and VNRs should incorporate sections that explore these interactions in policy processes and outcomes. There is significant room for improvement in this area as many synergies have yet to be identified and exploited. Moreover, while countries develop their NDCs and NAPs based on their own needs and ambitions, narratives and policies at the global level have a large influence on the development and implementation of national policies. Thus, more coherent policy at the global level is a prerequisite for forming and implementing coherent policy at the national level.

The governance and policy frameworks for both the Paris Agreement and the 2030 Agenda will need to change to align climate action with the broader SDGs. In the UNFCCC climate negotiations, only passing references are made to the SDGs and their links to climate change. Many UNFCCC delegations comprise negotiators, often from foreign ministries, rather than practitioners of development. Similarly, at the ministerial level, it is usually climate or energy ministries that attend COP meetings. Those with direct experience or responsibility for development issues rarely attend and are certainly not central

to discussions. With respect to UN agencies with responsibilities for development issues, they attend COPs but are peripheral to the negotiations. Moreover, many states expressed concerns when the SDG negotiations first began that integrating climate change into the discussions may make them even more difficult to achieve and that climate change should be kept to the UNFCCC process leading up to the COP21 conference in Paris. Despite this, negotiators and ministers from both the Global North and South consistently — and for varying reasons — stress the importance of addressing climate change as a development issue.

This provides not only an opportunity for common ground but is essential as attention in the UN climate process will need to turn increasingly to implementation and enhanced cooperation, and away from confrontational zero-sum negotiations. There is also an important coincidence between the emphasis on needing to halve emissions of GHG in this critical decade and achieving the SDGs over the same timescale. As such maximizing synergies between climate and the SDGs is essential, and the rhetoric on this needs to be turned into reality.

To enable nations and other stakeholders to implement pertinent climate change and sustainable development commitments in a cogent and mutually reinforcing manner, new linking of strategies and deliberations, such as the UN Climate Change Conferences and the High-Level Political Forum on Sustainable Development, will be important. These include the Addis Ababa Action Agenda on Finance for Sustainable Development, Sendai Framework for Disaster Risk Reduction, Convention on Biological Diversity, and other multilateral agreements concerning the environment, in addition to the range of commitments acknowledged in the Paris Agreement and 2030 Agenda. Newly enacted laws in Finland and Sweden (Teebken *et al*., 2021), compel the government to submit regular reports to the legislature regarding the alignment of its policies with the SDGs and their NDC. Therefore, there are very practical ways to turn rhetoric on the climate-SDG synergy into reality. This can include streamlining and avoiding duplications of reporting of NDCs, NAPs, LT-LEDS, and VNRs insofar as they relate to climate change. It could also involve the establishment of a new global platform that gathers evidence in support of enhancing synergies to address data and knowledge needs and strengthen the requirements for reporting on synergies. In addition, existing platforms can be used to provide unique intergovernmental and legal frameworks for capacity building and knowledge and experience sharing. For example, countries could report on their SDG progress using the Biennial Transparency Report (BTR) under the UNFCCC Enhanced Transparency Framework, as this process is already fully embedded and supported by national processes. Simultaneously, continuous interest must be ensured among countries in submitting VNRs and LT-LEDS.

2.2.3. Financing synergies

The financial sector plays a pivotal role in accelerating the process of transition to a low-carbon sustainable future. The Bank of England identified two primary financial risk factors associated with climate change and the process of transition namely physical risks and transition risks (Carney, 2015). Financial institutions face physical risk (often referred to as 'first order risks') from the direct adverse impacts of climate change, such as extreme weather-related events leading to higher credit risks and financial losses due to loss of assets (Park & Kim, 2020). Transition risks arise when an economy is in the process of adjusting towards a low-carbon economy where a large number of assets are at risk of becoming stranded — for example, investments in the fossil fuel sector such as power plants and oil refineries (Park & Kim, 2020) amounting to a discounted global wealth loss of USD 1-4 trillion (Mercure *et al*., 2018). However, these risks could have been mitigated by starting and financing the transition process earlier thus providing systemic certainty

and the necessary financial system stability. Moreover, investment in low-carbon technologies will also advance several SDGs which further strengthens the economic stability of a country and minimizes the risk of asset stagnation (Ahmed *et al*., 2022). However, investments in a low-carbon economy (often referred to as 'climate finance'), often fail to realize the value of SDGs and associated co-benefits of different green investments thus limiting the mobilization of climate finance, especially from the private sector (Karlsson *et al*., 2020). Therefore, understanding the synergies between climate action and SDGs can help to mobilize finance more effectively for a greater return. Studies have shown that investment in projects where SDGs and co-benefits are realized, achieve between 6–30% higher returns than projects that did not (Bleyl *et al*., 2019; Lou *et al*., 2022).

Looking at the Paris Agreement and the 2030 Agendas in isolation and separately, the investment gaps in financing interventions can be daunting. Despite climate finance almost doubling in the last decade, with a USD 480 billion annual average, there remains a significant shortfall of USD 4.3 trillion in annual finance flows by 2030 to be able to meet a 1.5°C global climate scenario and avoid the worst impacts of climate change (Naran *et al*., 2022), especially in low income countries, which benefit from only 8% of the global climate finance (refer to Figure A4) (OECD, 2022a). Similarly, despite the 7% growth in ODA from the Development Assistance Committee countries between 2019 to 2020, the SDG financing gap in developing countries rose to USD 3.9 trillion in 2020, exacerbated by the COVID-19 outbreak and global inflation (OECD, 2022b). Both figures, when considered separately, would typically mean that countries would opt for one to take precedence due to inadequate financial resources. However, what is often not realized in these evaluations are the developmental co-benefits of climate finance and climate co-benefits of ODA. It has been shown that transitioning to a green economy can generate new economic opportunities and jobs, where an investment of USD 1, on average, yields USD 4 in co-benefits through progress made in, for example, SDG 8 (Hallegatte *et al*., 2019). Similarly, climate-focused ODAs were found to engender benefits across SDGs 7 and 11, among others (Iacobuţă *et al*., 2022). Moreover, despite only 2% of international public climate finance or 0.5% of international development funding explicitly tackling air pollution, 72% (USD 7.6 billion) of air quality funding successfully addressed climate change due to energy and transportation sector mitigation measures, thereby delivering across various SDGs and climate targets (Clean Air Fund, 2022b). Such a success transpired despite the large misalignment of global air pollution financing needs, where Africa, Latin America, and some parts of Asia are consistently overlooked by funders. Integrative techniques that consider potential negative trade-offs that could degrade air quality or impede climate action can be used to address air pollution and climate action. Funders will be able to track and measure progress towards overlapping goals and increase the impact of their support if climate finance with air quality co-benefits is better accounted for (Clean Air Fund, 2022b). Therefore, had the synergies between climate action and SDGs been properly realized, the total investment gaps would have been lower, and it would have been easier to mobilize the finances to respond to multiple objectives. Financing tools are increasingly being used to leverage synergies and deliver co-benefits across both climate action and SDGs (some of these tools are presented in Table A2).

One example of such investment, where the synergy was realized, is the case of northern Sweden's industrial transition investment (NyTeknik, 2023; Rebecca, 2023; Smart City Sweden North, 2021). Steel producer SSAB, mining company LKAB, and energy company Vattenfall started HYBRIT (Hydrogen Breakthrough Ironmaking Technology) developed a fossil-free value chain for iron and steel production using fossil-free electricity and hydrogen, thus minimizing carbon dioxide emissions throughout the value chain. The project became the first in a wave of climate-smart investments in the region, including

additional green hydrogen steel production (H2GS), and expansions of battery manufacturing (Northvolt) and wind power installations. Swedish government funds and EU grants and loans complemented private capital; however, it was industry (with a mixture of private and public-owned companies) in the driving seat seeking long-term business opportunities. The companies had no difficulty finding customers despite the price premium compared to conventional steel. The mostly rural region, sparsely populated and victim of industrial decline and young people moving away following the recession years in the 1970s, is now experiencing a massive economic boom. Positive impacts on job creation and economic development (SDG 8) and innovation and infrastructure (SDG9) are clear and will contribute to reducing inequalities (SDG 10) between regions in the country. Local governments now have difficulty keeping up with the rapidly increasing demand for social services, schools, health care, housing, etc., for the growing population. Despite these complications, it is a remarkable turnaround for a region that has struggled during the last decades. The development in the north has become a Swedish flagship story, celebrated, and promoted by politicians of all political persuasions in different international fora.

Recognizing the opportunities in climate finance, the International Development Finance Club (IDFC)'s investment in mitigation efforts reached a record high of USD 186.6 billion in 2021. The goal is to support investments that will help countries become carbon neutral as soon as possible, while also promoting a just transition to a low-carbon economy (Climate Policy Initiative, 2022). A major share of this investment (32%, USD 60 billion) went to the energy sector including low-carbon transport, renewable energy projects (wind, solar, hydro), buildings, and energy efficiency.

Another example of investing in synergies is the Biogas Program in Vietnam, in which 'Gold Standard carbon credits' serve as a crucial source of funding through commercializing the avoided emissions from homes switching to biogas from dirty fuels. The nonprofit Nexus for Development oversaw and approved this program. About USD 8 million in carbon credit income was earned as of 2020, representing more than half of the program's operating expenses. Furthermore, it was hoped that only the proceeds from carbon financing would be used to fund the initiative beyond 2020 (Climate Policy Initiative, 2021). While the carbon market is still a relatively new idea within local and national governance systems, and the carbon money is fungible, it is unclear how carbon payments should be divided by the government that receives them due to a lack of proper legal and regulatory frameworks. Despite these administrative and legal restrictions, the scheme has shown the potential for carbon financing to support Vietnam in meeting its NDC (estimated at over 480,000 tCO_2 per year) and working to increase access to clean cooking in line with SDG 7 (Climate Policy Initiative, 2021).

Numerous best-practice examples involve locally led or small-scale interventions. However, these often-present financing challenges due to greater transaction costs and difficulties in connecting projects and funders. However, the Global Innovation Lab for Climate Finance is a network that enhances public-private partnerships by consolidating and accelerating broader government and private sector efforts to scale climate finance. Well-designed financial instruments can foster the transition of billions of dollars towards a sustainable, inclusive, net zero economy, while also reducing private investors' risks. Since 2014, the Lab has launched 62 instruments that have mobilized over USD 3.5 billion to address climate change (Global Innovation Lab for Climate Finance, n.d.). The Lab has been particularly successful in drawing finance from the private sector, which makes up nearly half of the total investment, with representatives from businesses, governments, nonprofit organizations, and entrepreneurs. The Lab further promotes sustainable investments that profit small business owners, smallholder farmers (of whom the majority are

women), and individuals and communities in developing economies who gain access to sustainable energy, reduced pollution, increased resilience to climate change through sustainable management of agriculture, forestry, and water resources, as well as lower emissions globally. The Lab selects projects that have strong capacities to mobilize private climate capital within a sizeable market and can be scaled up while achieving positive climate, developmental, and environmental outcomes. For example, Energy Savings Insurance, a Lab tool that started with a modest pilot in Mexico, has expanded to seven countries in Latin America, been replicated in Europe, and just received approval for adoption in Africa and Asia. Another example is Climate Investor One, one of the Lab's most effective tools that has helped to raise more than USD 850 million in climate investment. Similarly, the Breathe Better Bond initiative, a bond paired with technical assistance issued by local governments in certain low and middle-income countries in Africa, has successfully drawn upon the synergies of climate action and air pollution control measures by using proceeds to invest in projects that simultaneously reduce both air pollution and greenhouse gas emissions.

Some of the new challenges to effective policy coherence are the multiplicity of financing sources and the dispersed control of climate finance (Zelli & Asselt, 2013). Making policies and action plans that straddle sectoral and constituency interests is challenging, if not impossible, given the current fragmentation and proliferation of climate finance. Thus, it is not always possible to develop the necessary integrated methods and solutions for combating climate change, and the final solutions that are presented or proposed are often subpar. To deal with the dispersion and complexity of finance and governance, many nations are experimenting with new institutional arrangements, such as the establishment of national funding bodies and national climate funds (Flynn, 2011). Ethiopia has combined its development and climate change agendas to overcome the fragmentation of governance in these areas. Its Climate Resilient Green Economy (CRGE) strategy, adopted in 2011, is based on increasing the share of renewable energy in final energy use; introducing new technologies in transport, industry, and construction for better energy efficiency; and improving agricultural practices while reducing emissions. The plan encourages economic growth that is resilient to climate change and follows a low-emissions path (Gomez-Echeverri, 2018). The Growth and Transformation Plans (GTP) I and II, which are government tools for economic and social development, aim for high growth levels but with climate-neutral investments and policies (Gomez-Echeverri, 2018). Ethiopia reiterated its commitment to its NDC by committing to a number of extremely ambitious goals, including reducing its GHG emissions by 64% from the business-as-usual scenario by 2030 and concentrating on a select few industries like energy, buildings, water, agriculture, forestry, and transportation (Gomez-Echeverri, 2018).

Other nations have sought to incorporate considerations of SDGs and climate action into their ministries' annual business plans and financial budgeting. There have also been ongoing efforts on the Integrated National Financing Framework (INFF) at the national level, where some countries such as Colombia and Indonesia have developed INFFs that include strategies linking climate action with the SDGs, such as climate/SDG budget tagging. Similarly, Finland aims to ensure that the national budget process fully incorporates sustainable development (Teebken *et al*., 2021). Since 2018, all ministries must provide details on their initiatives for sustainable development and the SDGs in their budget proposals. This sectoral viewpoint was supplemented in the 2019 budget by explicitly including a new integrated section on 'Sustainable Development' that highlighted taxes and detrimental subsidies pertinent to their carbon neutrality target, thereby connecting the SDG and climate agendas (Teebken *et al*., 2021). New budget guidelines have also been established in Bangladesh for the 2030 Agenda and the environment (Bouyé *et al*., 2018) following a 2012 Climate Public Expenditure and Institutional Review that

revealed that ministries were not integrating climate action into their fiscal plans. This led to the creation of a climate fiscal framework in 2014 by the Ministry of Finance and the Poverty-Environment and Climate Mainstreaming Project of the Planning Commission. Following this, the Planning Commission changed the yearly development program rules to demand that climate action be included in the ministries' budgets. In addition, cities, such as in Indonesia and the Philippines, are also increasingly putting forth efforts to close the gaps in climate finance. They are doing so by diversifying financial approaches and building community-driven sustainability financing, improving internal capacity, information disclosure, and prudential regulations, developing bankable projects, and providing incentives to strengthen private sector engagement (Okitasari *et al*., 2023).

As countries continue to view potential trade-offs between climate change interventions and development as significant barriers to taking action to reduce their GHG emissions, the evaluation of distributional impacts of climate policies is extremely important for policymaking. It is well known that poorer groups in society are typically more susceptible to the negative effects of climate change, particularly when these effects interact with and intensify non-climatic stressors (L. Olsson *et al*., 2014). By omitting measures to mitigate the emission reduction policies' distributional effects, it has been argued that the costs of these policies may worsen their effects on the poorest households (Goulder, 2013; Grottera *et al*., 2017; Jakob & Steckel, 2014). The co-benefit of distributional implications particularly includes social justice, equity, poverty alleviation, energy access, and energy poverty. For example, climate mitigation measures like carbon taxes will exacerbate the effects on lower-income groups in the absence of proper channeling of tax revenue (Deng *et al*., 2017). Indeed, NDCs are projected to increase the global poverty headcount by 4.2% in 2030 compared to the baseline scenario (Campagnolo & Davide, 2019). Similarly, several LT-LEDS have reported a negative impact on GDP, and outlined the need for proper policy planning and technology cost reduction to overcome such trade-offs (UNFCCC, 2022). Transforming international climate finance to become pro-poor depends on the magnitude of funding provided to recipient nations. Specifically, receiving international financial assistance in the form of sector-specific subsidies accelerates efforts to reduce poverty in most nations of the Global South. The funds improve the GDP of large recipient nations, which in turn lowers the frequency of poverty (Campagnolo & Davide, 2019).

Drawing upon the synergies of SDGs and climate action allows for a more effective allocation of budgets and resources and contributes towards a more integrated policy and accountability framework. Some nations have established financial mechanisms for a just transition when pursuing ambitious climate targets and adaptation plans. Ghana's National Adaptation Plan includes projections until 2080 and lists the development of plans and measures to strengthen the nation's resilience to climate change, such as climate-resilient investments (Antwi-Agyei, 2018). A climate support package has been launched by the French Ministry of Inclusive Ecological Transition to socially support the country's national climate strategy including measures that offer financial assistance to socially disadvantaged households (Bouyé *et al*., 2018). This covers financial incentives for electric vehicles and energy-efficient renovations and includes provisions to mitigate the negative social effects of a carbon tax. Several countries have also instituted active labor market policies to ensure that the short-term and long-term changes brought about by the shift to a green economy are well-managed and beneficial for everyone, including the workers who will be negatively impacted by restructuring, the communities that will be affected by climate change, and the population groups who will be adversely impacted by green policies (ILO, 2017a). For example, in 2016, the Philippines passed the 'Green Jobs Act' to promote green jobs. The Act is intended to create, maintain, and provide incentives for green jobs in order to contribute to the growth of an eco-friendly economy.

Through a tax break for costs associated with retraining, research and development, and the duty-free importation of capital equipment used in the creation of green jobs, it promotes business companies to create green jobs (ILO, 2017a).

Numerous countries have attempted to integrate gender equality and poverty issues in climate change sensitive planning and budgeting, with efforts to establish green bonds, resilience bonds, and blue bonds in innovative climate finance markets, which aim to reduce the impacts of climate change and improve the resilience of communities, livelihoods and businesses (UNDP, 2021a). Considering the significant trade-offs between gender equality (SDG 5) and climate action, complementary financial packages are essential to address the impacts of these trade-offs across gender dimensions (Roy *et al*., 2022). In Kenya, access to finance from the national climate fund is required to be equitable across generations (Bouyé *et al*., 2018). A growing trend among public organizations is to include a gender perspective in climate finance, however, there is a general lack of information on this topic (Buchner *et al*., 2021). As women's livelihoods are typically more susceptible to climatic change, there is a chance to improve the synergies between gender- and climate-based sustainable development by utilizing their local knowledge, skills, and tendency for community involvement. The biggest opportunity exists for gender tagging to be used in adaptation and initiatives with multiple benefits (Buchner *et al*., 2021). However, only 0.7% of the monitored mitigation interventions had gender tags (Buchner *et al*., 2021). Overall, institutions are required to ensure fairness and social inclusion in the allocation of effort, costs, and benefits of initiatives under the banner of sustainable development. The panorama of climate and SDG-aligned finance and, consequently, the development of a just and sustainable transition, may be assessed with the aid of more detailed reporting from every stakeholder. In addition, paying attention to how climate finance benefits are distributed can aid in determining how effective capital flows are. To ensure that investments are getting to the people who need them the most, both the quality and the amount of climate finance are crucial.

Over the last decade, multilateral and bilateral donors have strengthened their standards for social, environmental, and climate-risk impact assessments and promoted the use of a sustainability strategy when developing projects. Some have pledged to guarantee that a certain proportion of their projects have a positive impact on climate. The French Development Agency (AFD) targets 50% of its projects while the World Bank Group targets 28% (Bouyé *et al*., 2018). An increasing number of donors, including the World Bank Group, the EU, the AFD, and the U.S. Agency for International Development, have the goal of integrating the SDGs and climate change in their multi-annual general, country, and sector policies. The New European Consensus on Development binds the 28 member states and EU institutions to "implement the 2030 Agenda and the Paris Climate Change Agreement through coordinated and coherent action, and maximize synergies", as well as to increase funding for sustainable development, including for climate action. Coherence in policy is highly valued for development. A few donors, such as the African Development Bank and the Inter-American Development Bank have also begun incorporating the SDGs and climate action into their reporting criteria (Bouyé *et al*., 2018).

Investment opportunities often face barriers due to a lack of resources. Hence, it is important to specify the source of finance. The main aim of climate finance is to improve market signals to curb emissions and enhance economic and social growth. Carbon pricing is used by many countries to fund these investments. Globally, 45 national territories and 25 subnational territories had carbon price programs in place as of 2018 or were slated to have them (Ramstein *et al*., 2018). Carbon pricing measures, which include carbon taxes and Emission Trading Schemes (ETS), have the potential to reduce global GHG emissions by 20% if

all the scheduled carbon price initiatives are effectively implemented (Ramstein *et al*., 2018). Since Sweden introduced a carbon tax in 1991 their carbon emissions have fallen by 25% (in comparison to the 1991 emission standard), and their GDP has increased by 64% (Christensen, 2015). The additional tax revenue has been reinvested in less carbon-intensive industries like geothermal and wood pellets, which have developed into major market players contributing to the growth in GDP (Christensen, 2015). In countries such as Denmark, Finland, Sweden, and Norway, which have implemented revenue recycling, carbon taxes are foreseen to have weak or insignificant adverse economic effects, such as on industrial and GDP growth and unemployment, due to reduced tax burdens on citizens (Känzig & Konradt, 2023).

2.2.4. Global best practices and policies

Synergies depend on context and scale, with the type of policies utilized dependent on national priorities and endowment. In the Global South, where most economies are significantly driven by agriculture and other land uses, land use regulation has received the most attention, for example, through community forest management and conversion of forestland to bioenergy crops. Agriculture features very prominently in the NDCs of several countries, with nearly 95% of developing nations emphasizing adaptation and 71% on mitigation from the agriculture sector (FAO, 2016). However, improperly planned climate actions have shown how the poor and marginalized, who often rely on land resources for their livelihoods, can be adversely affected by forcefully having to withdraw their lands to those in power (Sovacool, 2018). Best practices involve engaging various stakeholders in decision-making and governance to ensure a just transition.

Locally led interventions are important in realizing the synergies between climate action and SDG progress. For example, agroforestry systems have significant roles to play in biodiversity conservation as they comprise high plant diversity and structural complexity, incorporation of native species, enhanced habitat and landscape heterogeneity, and also serve as buffer zones, ecological corridors, and habitat for species that withstand some degree of disturbance (Ruf & Schroth, 2015). There are significant overlaps between major coffee and cocoa production areas and biodiversity hotspots, such as in Central America (Ruf & Schroth, 2015). Smallholder farmers, from Costa Rica and Ecuador, are responsible for most of the world's coffee and cocoa production. However, they are often low in capital, with low investment capacity in technical innovation, highly exposed to price volatility, and most vulnerable to climate change. As a result, Costa Rica developed sustainable certifications to provide market recognition for coffee agrosystems managed under sustainable practices, including the maintenance of shade trees. Shaded coffee farms with agroforestry-certified systems are prominent in the cantons of Turrialba and Orosi in Costa Rica and have been offering farmers and local communities numerous ecosystem services that advance a wide range of SDGs (6, 11, 12, 13, 15), through the improvement of water quality, erosion control, maintenance of habitats, pest, control, and serving as carbon stocks — advantages not experienced in non-certified communities (Pico-Mendoza et al., 2020). In addition, because they supply goods like fruits, firewood, and regional building materials, shade trees significantly support the economic viability of coffee estates in Central America (SDG 8) while improving the quality of the coffee produced and reducing the need for wood extraction from forest reserves and fallows (Pico-Mendoza *et al*., 2020). However, such agroforestry systems require careful planning that considers local environmental and social contexts to avoid potential trade-offs (Pico-Mendoza *et al*., 2020; Ruf & Schroth, 2015). Traditional agroforestry systems for cocoa, known as Chakra, are still widely practiced in numerous parts of Ecuador. Chakra combines the cultivation of the best aromatic cacao from Ecuador while controlling wood extraction, the manufacture of staple

foods, and the preservation of medicinal plants to enable the sustainable use of forests (Torres *et al*., 2015). Although Chakra does not offer significant economic advantages over conventional methods, it enables people in the Amazon to support food security (SDG 2), general wellbeing (SDG 3), and biodiversity preservation (SDG 15). In addition, Chakra has a better rate of carbon sequestration and a greater variety of trees than other types of land use, making it more effective at adapting to climate change (SDG 13) (Caicedo-Vargas *et al*., 2022; Torres *et al*., 2015).

Numerous SDGs have interlinkages between climate action, agricultural production, natural resources, and ecosystem management, as well as income and/or food security. Given its goals to concurrently enhance productivity and income, foster resilience, and, whenever possible, decrease or eliminate GHG emissions, climate-smart agriculture (CSA) lies at the intersection of these development imperatives. As a result, CSA offers the potential to accomplish more SDG objectives than agriculture or climate initiatives with a narrower focus because of its multi-objective character. CSA in general was referenced in the NDCs of 56 countries, with 24 specifying it as a mitigation measure and 47 as an adaptation measure (Freed *et al*., 2023). Ecuador is beginning to advance CSA, with its first project launched in 2016. A significant contributor to the nation's emissions is the livestock industry. It also has a propensity for low production and is extremely vulnerable to climate fluctuation and change. Climate-Smart Livestock Management, Integrating Reversion of Land Degradation and Reduction of Desertification Risks in Vulnerable Provinces, or simply the Climate-Smart Livestock project, is a GEF-funded initiative that focuses on both mitigation and adaptation in the livestock sector. It is being piloted in seven provinces to lower emissions, sequester carbon, and increase livestock systems' resilience, increase outputs and incomes. The initiative was created to advance the NDC's agricultural focus and additionally supports SDGs 1, 2, 8, 12, 13, and 15 (FAO, 2019). This pilot program is intended to become an integral component of Ecuador's national agriculture planning. CSA is also prominent in Bangladesh, a country sensitive to the impacts of climate change. Evidence of climate change in Bangladesh can be seen in an accumulation of heavy rains, frequent storms, and rising sea levels that result in severe flooding. Due to continuous water-logged conditions, which last nearly six months, crops are often lost and land for agriculture has become scarce. Many meteorological models have predicted that the intensity, extent, and depth of floods in Bangladesh will increase in the near future, which would make farmers even more vulnerable. In waterlogged areas of southern Bangladesh, floating agriculture has already been a successful crop production method and is noted as an economically viable practice. Initially developed out of necessity, the floating gardens approach uses local skills and knowledge for adaptation to the prolonged flooding season and builds resilience to flooding. Farmers operating floating gardens system receive an average gross return of USD 265 and a net return of USD 134 per season (FAO, 2015). By comparison, when cropping on plain land, farmers receive an average gross return of USD 31 and a net return of USD 10 (FAO, 2015). The floating gardens production system clearly increases the farmers' incomes and is more profitable than vegetable cultivation on plain land (SDG 7) (Chowdhury & Moore, 2017; Enamul Haque *et al*., 2022). Other benefits include the minimal reliance on fertilizers and pesticides, the production of biomass as organic fertilizer post-cultivation, and the use of floating gardens as shelters for poultry and cattle (Chowdhury & Moore, 2017; Enamul Haque *et al*., 2022). The organic production of vegetables is also important for local, urban, and export markets. At present, floating agricultural practice in Bangladesh has been recognized as a successful strategy for building resilience in waterlogged areas and is seen as a possible adaptation strategy against climate threats (SDG 13). In addition, it is also linked to several sustainable development goals including reducing hunger and poverty (SDGs 1, 2, and 3), increasing food security (SDG 2), and even empowering women (SDG 5). Many of the workers in such farms are women as it requires less physical labor. Little investment is required as country boats are used for the collection of water hyacinth, carrying of produce, and other inputs.

Many countries of the Global South have demonstrated a commitment to combating climate change through various programs and interventions targeting mitigation through forests and other ecosystems. The REDD+ partnership is a global GHG mitigation and adaptation strategy recognized under the Paris Agreement. REDD+ is a way of offering nations in the Global South readiness finance and results-based payments to lower their GHG emissions from forest loss. The rate of deforestation is still significant in tropical nations despite government regulations. In Latin America and the Caribbean, forest area decreased from roughly 51.3% in 1990 to 48.2% in 2015, whilst the forest area in sub-Saharan Africa decreased from 30.6% to 27.1% over the same period (FAO, 2018). Since its inception as an international financing mechanism to prevent deforestation, REDD+ has grown significantly. It now recognizes that to achieve its goals, it is necessary to address the causes of deforestation and forest degradation, which in many countries calls for a change in the rural economies' primary drivers of growth, such as commercial agriculture, mining, and infrastructure development to more low-carbon alternatives (Kissinger *et al*., 2012). Countries must explore national policy changes and 'non-carbon benefits' to address causes and reduce GHG emissions from the forest industry. Two SDGs (13 & 15) are the most compatible with the objectives of REDD+ (Bastos Lima *et al*., 2017). Indonesia's REDD+ efforts have provided further co-benefits with other SDGs, such as SDG 3 (improved mental health and wellbeing for forest-dependent people derived from cultural continuity, and slowing rate of emergence of vector-borne diseases, and improving availability of medicine and pharmaceutical to non-forest dependent people), SDG 6 (clean water), SDG 2 (nutritional and spiritual value of forest-derived foods), and SDG 16 (protection from natural resource violence) (Spencer *et al*., 2017). Moreover, forests supported by REDD+ protect watersheds that support both small- and large-scale agriculture (SDG 2), provide protection from flooding and landslides during heavy precipitation events (SDG 11), and provide non-timber forest products (such as food and fuel) that sustain populations on a daily basis (SDG 7, 8) (Spencer *et al*., 2017). In the fight against climate change, protected areas have an edge over other ecosystem management systems in terms of governance clarity, capacity, and effectiveness (Dudley *et al*., 2010). One of the 76 natural protected areas overseen by Peru's National Service of Natural Areas Protected by the State is the Nor Yauyos-Cochas Landscape Reserve, which is situated in the Andean highlands. The 'no-regret measures' undertaken in Canchayllo and Miraflores (Podvin *et al*., 2014) seek to provide greater resilience to climate change by offering sustainable water and grassland management where upper micro watersheds, wetlands, watercourses, and their associated vegetation (primarily grasslands) are maintained to supply water storage, groundwater recharge, and regulation services (SDG 6, 15), and community-based sustainable native grassland management to improve pastoral livelihoods and boost resilience to extreme climatic events (SDG 1, 2, 8, 13, 15).

In the Global North, synergies often feature in the region's pathway to a clean energy transition, where these countries have accounted for 80% of global spending and for almost all of the growth in recent years (IEA, 2023). With energy contributing the majority of the global GHG emissions, these regions comprise some of the largest energy consumers per capita (over 50,000 kWh), including Iceland, Norway, Canada, and the United States (British Petroleum (BP), 2022). The average person in these countries consumes as much as 100 times more than the average person in some of the poorest countries. The global energy-related CO_2 emissions reached over 36.8 Gt in 2022, with net increases primarily seen in North America, one of the biggest consumers of energy per capita, and the Asia Pacific (excluding China) (International Energy Agency, 2022). Of the 321 Mt of CO_2 increase, 60 Mt can be attributed to cooling and heating demand in extreme weather (International Energy Agency, 2022). In the UK, where the building industry is responsible for a considerable amount of GHG emissions (UKGBC, 2018), the reduction of energy consumption by buildings through energy efficiency measures is key. There were reportedly 34,300 excess winter deaths

(EWD) during the winter of 2016–17, with cold homes contributing to around one third of these deaths (Jennings *et al*., 2019). EWD was assessed to be three times higher in the coldest quarter of homes compared to the warmest quarter, and children living in homes with insufficient heating were shown to have a greater than double risk of developing respiratory illnesses such as asthma and bronchitis (Jennings *et al*., 2019). To combat this, the Gentoo Group and Sunderland Clinical Commissioning Group ran a small-scale project called 'Boilers on Prescription', which entailed 'prescribing' NHS patients living in cold, damp homes with energy retrofit measures, such as double glazing, boilers, and insulation by their GP. The project successfully lowered the number of GP appointments needed by patients taking part in the scheme by 60% and reduced accident and emergency attendance by 30% (Jennings *et al*., 2019). Overall, an investment of £1 in keeping homes warm saved the NHS £0.42 in direct health costs. Moreover, patients of older age groups reported significant improvements in health status and mental wellbeing, and the overall levels of happiness and life satisfaction were also reportedly higher than the UK average (Bray *et al*., 2017). The energy efficiency measures also allowed participating households to save up to £94.79 over a period of six months (Bray *et al*., 2017). As a result of the patients' improved health and wellbeing, the project contributed to advancing SDG 3, while allowing households to earn energy-related savings contributed to SDGs 1, 7, and 8, as they had greater disposable income that they could use to enhance their quality of life or escape energy poverty. Similarly, Leadership in Energy and Environmental Design (LEED)-certified buildings in the USA helped save 88.5 billion kWh between 2000–2016, amounting to up to USD 6,710 million (MacNaughton *et al*., 2018). This helped ease the burden on the nation's fossil fuel imports and attain a greater level of energy security (SDG 7). Moreover, as a result of the avoided GHG emissions (30,601 kt) and air pollutant emissions (65.19 kt) between 2000–2016, climate and health co-benefits of USD 3,970.96 were generated, with an estimated reduction in 172–405 premature deaths, 11,000 asthma exacerbations, 171 hospital admissions, 54,000 respiratory symptoms, 16,000 lost days of school, and 21,000 lost days of work (MacNaughton *et al*., 2018), contributing to the advancement of SDGs 3, 4, 8, and 11 due to improved health and wellbeing, lower exposure to air pollution, greater work environments, and greater accessibility to quality education due to improved health.

Most people live and work in cities, and urbanization is expected to continue to increase across the world, with 70% of the population residing in urban areas by 2050. Sixty-three percent of the OECD's GDP is concentrated in 327 metropolitan regions with 500,000 or more residents. Thus, the ambitious goals of the 2030 Agenda cannot be met by national governments alone — cities and regions must also play a major role as they have underlying strengths in the SDGs' policy sectors, including water, housing, transportation, infrastructure, land use, and climate change. The city of Kitakyushu, Japan showed how the environmental SDGs could create opportunities in the economic and social sectors after installing eco-industry offshore wind power generation and creating eco-tourism which offers more job opportunities for youth and promotes social cohesion through intergenerational solidarity (OECD, n.d.). Furthermore, after the Third Global Conference on Strengthening Synergies between the Paris Agreement and the 2030 Agenda for Sustainable Development, Japan has also pledged to create over 100 'decarbonization leading areas', or regions that will aim to reach net-zero emissions by curbing GHG emissions (SDG 13) from electricity usage in homes and businesses (SDGs 7, 8, 9, and 12), as well as the transportation sector (SDGs 9, 11, and 12) (Taniguchi, 2022). By putting this into practice by 2030, the program will demonstrate how inhabitants' quality of life (SDG 3) may be raised by resolving neighborhood issues (SDG 16) in a variety of places, including villages, isolated islands, and urban townships (Taniguchi, 2022).

With increasing urbanization, there has been a significant movement of populations from rural to urban centers in search of new opportunities since the early 20th century, which has resulted in subsequent increases in economic growth, access to education, diversity, as well as GHG emissions. Overall, these population movements tend to be on the rise in the context of disasters, climate change, and environmental degradation. The World Bank predicts that climate change could contribute to the movement of 216 million people within their own countries by 2050, unless concrete climate and inclusive development actions are taken (World Bank Group, 2021). However, situations vary as they are compounded by other interconnected and complex political, security, economic, and social factors (Warner *et al*., 2010). Despite this, migrants and other mobile populations are unique sources of diversity and innovation in cities. In the context of climate adaptation, they bring diverse knowledge and expertise in various areas, such as disaster risk reduction strategies and sustainable consumption habits, enhance cultural offerings, and have the potential to fill green jobs. For example, the Pikine and Rufisque departments of Senegal present a successful case study of how labor migration contributes to urban resilience. These areas are the main agricultural areas and the primary site for horticultural products, accounting for over 80% of the national vegetable production (IOM, 2022). Thus, the area offers employment opportunities, especially due to its proximity to the capital, Dakar, as well as the industrial fabric of Rafisque and the nearby areas. Consequently, an 18-month long project, called the 'Protection and Insertion of Migrant Labour and Environment in Urban and Peri-urban Agriculture in Senegal and Côte d'Ivoire', or MITSA, was launched in Senegal to build on in-depth research to determine how the two departments have evolved over the past two decades amid the various environmental and socio-economic factors. Findings from the project will be used to pilot solutions that will be proposed for the survival and viability of these areas against the rapid urbanization that is threatening these regions, and consequently, food security, livelihoods, and their economic fabric (IOM, 2022).

Transportation is another major sector where an energy transition is imminent. Investment in low-carbon transport is the fastest-growing sector, with private road transport (electric vehicles and battery chargers) accounting for nearly half of the low-carbon transport financing, with annual consumer spending of USD 25 billion on EVs in 2019–2020 (Buchner *et al*., 2021). However, active travel (walking and cycling) also has an important role in decarbonizing the transport sector, albeit a less dominant one. Active travel is largely associated with health co-benefits (Winters *et al*., 2017). New Zealand's Model Communities Program funded cycle paths, other walking and cycling facilities, cycle parking, 'shared spaces', media campaigns and events, such as 'Share the Road', and cycle-skills training in particular cities (SDG 11). This resulted in annual health benefits for these cities in the form of 34.4 disability-adjusted life years (DALYs) and two lives saved due to reductions in cardiac disease, diabetes, cancer, and respiratory disease (Chapman *et al*., 2018) (SDG 3). Moreover, a cost-benefit analysis utilizing a value of CO_2 emission reduction to be USD 125/tonne and a discount rate of 3.5% resulted in a benefit-to-cost ratio of 11 to 1 (Chapman *et al*., 2018).

However, due to the significant effects that transport has on various social groups' ability to participate in economic and social life, as well as on their health and welfare, a just transition in mobility is important (Mullen, 2021). For example, switching to EVs will improve air quality and help mitigate climate change (SDG 13) while also creating health benefits (SDG 3), but the cost of the transition could limit access to employment and educational opportunities (SDG 4 and SDG 8) and exacerbate poverty, food insecurity, and inequality (SDG 1, SDG 2, SDG 5, and SDG 8) (Mullen, 2021). In the UK, the bottom 20% of families have less than 4% of the country's ultra-low-emission automobiles, while the top 20% of households have more than 50% (Kumar, 2019). If not managed well, the transition to EVs could result in an increase in exclusion

linked to transportation. Exclusion or hardship might also occur if taxes, such as those related to clean air zones or low-emission zones being implemented or planned in cities across Europe, were used to punish conventional, high-emitting vehicles without taking into account the tax burden placed on low-income families (Mullen, 2021). As a result, calls for action to help lower-income households purchase EVs and improve the distribution of public charging infrastructure have arisen (Kumar, 2019). Although supporting EVs has the potential to reduce some transportation-related disparities, how this is accomplished depends heavily on the type of support provided. Low-income groups are unlikely to be able to afford new EVs with the £3,000 subsidy provided by the UK government, and will not benefit individuals who are less able to operate a motor vehicle, such as non-drivers (Mullen, 2021). On the other hand, fairness-driven low-carbon mobility system designs are being used in numerous places. Sao Paulo has made significant investments over the past decade to build over 100 km of bus rapid transit (BRT) and cycling lanes, as well as a large number of shared bikes and conveniently accessible pedestrian blocks (Institute for Transportation & Development Policy, 2015). As a result, the average travel time for passengers has been cut by nearly 19% and contributed to a daily reduction in GHG emissions of roughly 1.9 tonnes (SDG 11, 13) (Institute for Transportation & Development Policy, 2015). BRT has also helped lower-income people and decreased traffic collisions (SDG 3, 8, 11). Similarly, Bogotá and Curitiba, two cities that engage in BRT initiatives, have increased the average commercial bus speed to between 18—28 km/h and 17.5 km/h, respectively, carrying 1.6 million and 2.26 million people daily (Yüce & Babalik-Sutcliffe, 2012). Bogotá is known for its Transmilenio BRT network and has promoted travel demand management and non-motorized transport strategies through the establishment of bike lanes and pedestrian zones linked into the BRT system (SDG 3, 11). These are expected to save more than 300 tonnes of CO_2 daily (from the 1997 baseline) and cut private car trips by a little over 2%. The system also emits 900 tonnes (12%) less particulate matter, 170 tonnes (43%) less sulfur dioxide, and roughly 6,800 tonnes (18%) less nitrogen oxides compared to the baseline year of 2006 (SDG 3, 7, 11) (Labriet *et al*., 2009).

2.2.5. Barriers and enablers of synergistic action

The generally poor adoption of a synergistic approach to addressing the 2030 Agenda and Paris Agreement can be attributed to a weak science-policy-society interface. Previous sections have demonstrated findings from a multitude of studies that attest to the synergies between climate action and policies aimed at delivering SDG and climate targets. In fact, there is a growing number of modelling strategies within the literature. However, there remains a huge disconnect between scientific evidence and applied policy action. It is, therefore, crucial to strengthen scientific evidence and policy actions by addressing the wide range of barriers that persist in their interface. It is worth noting that the categories used to classify these barriers are not perfectly distinct from each other. Most overlap and reinforce each other. The mutually reinforcing nature suggests why achieving synergies can be challenging. It requires finding appropriate leverage points that can tap into dynamics that can drive forward transformative systemic changes.

Knowledge barriers: Clearly the targets and goals of the 2030 Agenda and climate action are inherently interlinked, which gives rise to co-benefits and trade-offs between them across various dimensions. To address these interactions, there is a crucial need for policy integration or coherence. Policy coherence offers the opportunity to induce the transformative change that is necessary for the achievement of sustainable development and climate change mitigation and adaptation (Teebken *et al*., 2021). However, policy coherence is one of the biggest challenges in the implementation of SDGs (Pham-Truffert *et al*., 2020; Pradhan *et al*., 2017; Warchold *et al*., 2021; Zhao *et al*., 2021). Existing literature has attempted to aid policy integration by developing various ways to map and quantify SDG and climate action interactions.

Blue Carbon Ecosystem Projects in Kenya

Blue carbon ecosystems (BCEs) (mangroves, salt marshes, and seagrass meadows) can absorb carbon up to 50% faster than forests on land. As such, they are highly efficient carbon sinks and have the potential to make an important contribution to climate change mitigation (Lang *et al*., 2021). The protection and restoration of BCEs are increasingly recognized as important forms of nature-based solutions for achieving climate policy initiatives at local and global scales (Dencer-Brown *et al*., 2022). Moreover, the protection and restoration of BCEs offer potentially high returns on investment (Dencer-Brown *et al*., 2022). Kenya has around 612 km^2 and 317 km^2 of mangroves and seagrass respectively, and incorporating these habitats into national climate action has the potential to accelerate their low carbon development pathway (Lang *et al*., 2021), while providing job opportunities (SDG 8), enhancing food security (SDG 2), improving livelihoods of coastal communities and contributing to the economy (SDG 1, 8). Therefore, Kenya has incorporated a variety of conditional and unconditional commitments relevant to BCEs into their updated NDCs reflecting the increased understanding of the potential role that BCEs may play in climate mitigation and adaptation (Dencer-Brown *et al*., 2022; Lang *et al*., 2021). In Kenya, two programs have been mobilized to exploit the advantages offered by BCEs — the Mikoko Pamoja Project, a community-led mangrove conservation and restoration project in Gazi Bay that has been operational since 2010, and the Vanga Blue Forests Project, a community-led initiative that utilizes funds from carbon credits for reforestation and the restoration of a mangrove. The primary source of protein for the coastal towns, well-maintained mangrove trees shield coasts from erosion, hurricanes, and sea level rise (Dencer-Brown *et al*., 2022). In a region where the majority of the population cooks with wood, BCEs also offer a source of sustainable fuelwood (Shilland *et al*., 2021). They sustain a large amount of biodiversity, and their soil is an excellent carbon sink. The Mikoko Pamoja conserves 117 hectares of state-owned mangroves, representing almost 16% of the ecosystem in Gazi Bay. Over the 20 years from 2013 to 2033, the project seeks to protect 107 hectares of natural mangrove forests and conserve 10 hectares of red mangrove plantations that were established in denuded areas in the early 1990s (Huff & Tonui, 2017). As a result of these efforts, Mikoko Pamoja became the first-ever blue carbon initiative in the world that sold carbon credits from mangrove conservation activities for community development. Plan Vivo, a carbon certification organization that markets itself as pro-poor values, social responsibility, and transparency, validated Mikoko Pamoja to sell at least 3,000 metric tons of CO_2 equivalent per year from 2013–2033. This arrangement is expected to generate annual revenues of about USD 130,000 for the coastal villagers (Kanhema, 2023) (SDG 8). The Mikoko Pamoja project has funded pumps, providing clean drinking water (SDG 6) for several hundred children in primary schools in Gazi and Makongeni and nearly 5,400 people in the broader community (Huff & Tonui, 2017). The project also helped with the purchase of textbooks, sports uniforms, and other learning materials for 700 children (Huff & Tonui, 2017) (SDG 4). Particular efforts have also been made to improve community engagement in the management of resources, by situating project offices in places accessible and familiar to locals, and being respectful and considerate of the traditions and religious and cultural norms of the local population (Huff & Tonui, 2017) (SDG 5, 10). The Vanga Blue Project, was launched by UN Environment as part of the Global Environment Facility Blue Forests Project and the International Coral Reef Initiative/UN Environment coral reefs small grants program (Dencer-Brown *et al*., 2022), and is funded by the Leonardo Di Caprio Foundation. Other partners include the Kenya Forest Service and the Kenya Marina & Fisheries Research Institute. The Vanga Blue Forest has enabled the protection of 460 hectares of mangroves (SDG 15) and community development projects supporting the livelihoods of nearly 9,000 people (SDG 1, 8), while serving as a sink for over 9,000 tonnes of carbon (SDG 13) (Association for Coastal Ecosystem Services, n.d.). Nevertheless, to properly realize the benefits of BECs in Kenya, financial support is greatly dependent on international sources while maintaining inclusivity and streamlining the site-specific initiatives into national and international frameworks (Lang *et al*., 2021).

For the assessment of SDG interactions alone, approximately 30 methods exist all of which present a wide range of benefits, resource needs, and applicability (Horvath *et al*., 2022). However, most of these synergy studies are abstract and are thus of limited use to policymakers who deal with problems on the ground (Gusheva *et al*., 2022), and their applications are often highly inadequate or irrelevant to the policy contexts (Andersen, 2017; Balbus *et al*., 2014; Workman *et al*., 2018). Moreover, there is a lack of interdisciplinary

The Success Story of China's 2013 Air Pollution Prevention and Control Action Plan: Synergizing Air Pollution Control with Climate Action

Air pollutants and carbon emissions predominantly originate from the same sources, namely, the combustion of fossil fuels. As China has much richer coal resources than oil and gas, the enormous volume of coal burning has caused significant air pollution and made the country the largest current greenhouse gas emitter. From 2000–2012, China's total coal consumption increased threefold, leading to a rapid increase in its carbon emissions.

Recognizing that the premise of public participation in environmental protection is transparency and openness of environmental information, China took disruptive measures to require major air emitters to install online devices and disclose monitoring data every hour to the public, subjecting tens of thousands of large coal power, iron and steel, cement, and chemical plants to public scrutiny. Enforcement of environmental laws and regulations were strengthened and aimed at safeguarding air quality. Following the monitoring and hourly release of $PM_{2.5}$ data, China initiated the 'Air Pollution Prevention and Control Action Plan' in 2013, which proposed to strengthen comprehensive management and reduce multi-pollutant emissions; give full control to market mechanisms and improve environmental and economic policies; improve the system of laws, regulations, supervision and management; clarify the responsibilities of government, enterprises and people, and mobilize the whole of society to participate in environmental protection.

Reductions in pollutant emissions have led to significant improvements in air quality. From 2013–2022, the average concentration of PM2.5 in China's major cities has decreased by up to 58%, (from 89.5 μg/m³ to 30 μg/m³ in Beijing). In the process, thousands of coal mines have been suspended or shut down and energy restructuring has been launched in key regions such as Beijing, Tianjin, and Hebei. To solve the problem of frequent heavy pollution in autumn and winter, China issued policies to promote measures such as the replacement of coal with electricity or gas, and energy conservation and pollution control of coal-fired boilers. In 2018, the National Development and Reform Commission (NDRC) issued notice on resolving overcapacity that helped reduce more than 55 million tons of steel capacity and 250 million tons of coal capacity. Through these efforts China's coal consumption has been stable since 2013. Such actions helped the global fight against climate change, with China's clean air actions achieving a cumulative synergistic reduction of 2.43 Gt CO_2 emissions from 2013–2020 (Shi *et al*., 2022).

Studies show that air pollution increases mortality and morbidity and the exposure to outdoor fine particulate matter (PM2.5) is the fifth leading risk factor for death worldwide, accounting for 4.2 million deaths in 2015 (A. J. Cohen *et al*., 2017). A report found that China's clean air efforts have contributed to 75% of the global reduction in air pollutants and are expected to increase average life expectancy of its residents (Greenstone *et al*., 2022). Research (Xue *et al*., 2019; Xue, Guan, *et al*., 2021; Xue, Han, *et al*., 2021; Xue, Zhu, *et al*., 2021) also found that since the initial implementation of the Air Pollution Action Plan in 2013, the reduction of medical expenses and depression risks and improvement of lung function among middle-aged and elderly people were significantly related to the reduction of PM2.5 concentration, contributing to SDG targets 3.9 and 11.6.

Despite the progress made, air pollution levels in most major cities in China are still significantly higher than WHO standards. With most of the 'low-hanging fruit' picked and the end-of-the-pipe solutions implemented, China's decade-long clean air campaign will rely on the transformations of energy sources, industrial structures, and transportation models. As China has committed to peaking its CO_2 emissions by 2030 and achieving carbon neutrality by 2060, scientists have advocated for a synergistic approach to address climate change and air pollution, believing that these goals can serve as powerful drivers for future air quality improvement (Zhang *et al*., 2023). They identify that considerable health and economic benefits can arise from such a synergistic approach in addition to reducing the incidence of extreme weather events, saving pollution control costs, improving the structure of the economy, promoting new industries, and creating jobs.

knowledge sharing between relevant academic disciplines (Rennkamp & Boulle, 2018). Insufficient knowledge of SDG and climate action interactions remains a major challenge, often resulting in spillover effects of development policies between sectors, and missed opportunities in pursuing trade-offs (Bandari *et al*., 2022). Moreover, there is still a general lack of policy-relevant and accessible tools to quantify and monetize the co-benefits of undertaking synergistic action, which can hinder the decision-making process (Rashidi *et al*., 2017; Rennkamp & Boulle, 2018; Ščasný *et al*., 2015). To date, the only tools at hand tend to assess a limited range of co-benefits, such as air pollution, health benefits, and employment gains. However, it is also important to measure the magnitude of the impacts of a synergistic policy across other social and environmental dimensions. Indeed, co-benefits are very difficult to measure or quantify, particularly for bottom-up or distributed co-benefits, due to a lack of a globally comprehensive reporting system. Also importantly, it is difficult to measure or evaluate the impacts and effectiveness of pursuing synergistic policies (UN DESA, 2021). Therefore, without a clearer idea of what the outcomes of synergizing climate action and SDGs might be, policymakers may be unwilling to take up such strategies.

Globally, very few research institutions or university departments work at the science-to-policy interface, thus there are few opportunities for the exchange of ideas. There are still research gaps even though the effects of climate action on the SDGs have been extensively studied. Future scientific research collaboration is required to improve the evidence for the following topics: (1) the effects of achieving the SDGs on climate action; (2) the connections between climate adaptation and sustainable development; (3) the connections between climate action and social welfare; (4) the indirect connections as opposed to direct connections; and (5) the connections that are important for developing nations (Matsushita *et al*., 2023). To inform conversations about how to strengthen policy tools and governance structures, future research must also offer clear directions on how to strengthen synergies in the development of coherent and effective policies.

Likewise, very few government departments have dedicated scientific branches providing knowledge-based advice. It is essential that researchers gain some understanding of the intricacies and nuances of decision-making processes such that research outcomes can be presented in a policy-relevant manner. It is important to remember that scientists do not make policy. Similarly, it is incumbent on policymakers and bureaucrats to understand the scientific rationale underlying various policy options to enable objective policymaking. Thus, there is a mutual obligation between researchers of different disciplines and policymakers to strengthen their relationships to ensure the best scientifically verified policies are developed and implemented.

Importantly, there is a critical worldwide shortage of skilled practitioners with the necessary knowledge to successfully identify and implement the cross-sectoral opportunities presented by a synergistic approach to climate and development. Universities continue to be structured along traditional disciplinary lines with very few offering qualifications, or undertaking research, in multidisciplinary areas such as sustainability (although the number is growing). Similarly, few research institutions utilize a systems approach in their research. Action on climate and sustainable development requires a multidisciplinary and systems approach across both the knowledge and policy sectors.

Political and institutional barriers: The successful achievement of the objectives of the Paris Agreement and the 2030 Agenda requires strong institutional structures and effective governance. The ability of policymakers to create and implement action plans to address climate change and development in an integrated, coordinated, and comprehensive manner across sectors, regions, and constituents is essential to the success and effectiveness of policymaking. The vast majority of climate action impacts on the SDGs

are dependent on governance (Iacobuţă *et al*., 2021). Globally, government departments, at all levels, are still structured sectorally (*e.g.*, finance, health, environment, education, etc.) operating in silos, with few cross-sector portfolios (Amanuma *et al*., 2018). The lack of coordination between and within government agencies with climate and related portfolios is well-chronicled (Peters, 1998; Peters, 2018). The clearest examples of these challenges involve the exclusion of agencies with potentially relevant inputs such as sustainable education and lifelong learning into climate policy discussions. A reliance on models that are better equipped to deal with energy-consuming sectors than lifestyle changes may also be a symptom of these interagency institutional barriers. Similar constraints can lead to fragmented or incoherent decisions between governments at different levels. This may result in local governments being given mandates to implement ambitious climate targets without the capacities to make them locally relevant or the resources to implement essential investments.

Complex governance arrangements, overlapping authority, lack of mandate, department-specific jargon, unequal access to information, lack of transparency, and pre-existing knowledge and values can make communication between government departments difficult and emerge as barriers to policy integration and coherence (Alam *et al*., 2018; Bandari *et al*., 2022; Gjorgievski *et al*., 2022; Gusheva *et al*., 2022; Huan *et al*., 2023; P. Jiang *et al*., 2013; Karlsson *et al*., 2020; Keohane & Victor, 2011). It is also important to consider that perceptions and preferences can vary a great deal across actors in a government. Some departments will easily accept mechanisms that establish clear boundaries but with communication channels and room for action; others will want to follow a more united and collective approach and another group will have witnessed failures from a long line of earlier whole-of-government attempts and will want to see concrete action before committing (Molenveld *et al*., 2020). Moreover, with several departments co-owning initiatives, accountability for different stakeholders can become blurred, priorities may become diluted, and the loss of control and autonomy may lead to significant inertia in advancing cross-institutional collaboration (UN DESA, 2021). Due to the need for additional time and resources for extra coordination across institutions, especially in the Global South, there is a general structural rigidity and lack of political will and commitment to consolidate actions to address both climate and developmental goals because each policy and program is built around certain priorities (Matsumoto *et al*., 2019) and coordinated actions can be difficult to reconcile across certain goals, climate action, and economic ambitions of the countries (Bandari *et al*., 2022; Huan *et al*., 2023; Kostetckaia & Hametner, 2022; Mir *et al*., 2022). The relatively low momentum in recent history for various integrative sustainable development initiatives, such as Agenda 21 in 1992 or the National Sustainable Development Strategies (NSDS) from 2002 speak to this point. The processes around these strategies quickly became marginalized in most countries and ended up far from key government priorities and decision-making.

Moreover, decision-making powers and capacities are often concentrated within limited actors, who may not prioritize working on realizing the advantages of the synergies. It may also be that potential benefactors may lack the power or institutional channels to advocate for reforms that could deliver these benefits. For example, younger people may be a strong ally in the pursuit of synergies but lack recognized political standing in fora that drive high-leverage change (Arnold *et al*., 2009; Han & Ahn, 2020). Similarly, policies may be designed to — deliberately or unintentionally. — place a premium on climate at the expense of other development priorities (OECD, 2018; Shawoo *et al*., 2020; Zhu *et al*., 2022). For example, policies that promoted diesel vehicles in an effort to achieve ambitious climate goals may have led to an increase in particulate pollution and poorer health (Anenberg *et al*., 2017). Incoherence across policies can also be a concern, for example, if policies provide incentives for urban sprawl while others push for compactness and mixed land use planning within cities (Zusman *et al*., 2012).

Differing political priorities and competing objectives are further exacerbated by the nature of typically short-term political cycles when key ambitions are often traded off with each other (Jennings *et al*., 2019). Moreover, certain countries, such as the EU, have already exploited the most obvious synergies, meaning that further improvements would require substantially greater efforts (Kostetckaia & Hametner, 2022). In addition, unlike the general consensus that points to the need for policy coherence in addressing SDGs to improve inequality, one study reported that policy coherence can, in fact, worsen inequalities, and thus should not be sought as a panacea (Browne *et al*., 2023). Trade-offs will continue to persist, and these need to be minimized with complementary pro-poor and pro-environmental policies (Crentsil *et al*., 2020; Dyngeland *et al*., 2020), which can be costlier in the long run. There is also currently a lack of consistency on commitments to equity, gender equality, and other social justice and rights commitments across all indicators that would underpin climate justice and therefore advance synergy and impact on climate action and all SDGs (Fischler *et al*., 2016). To properly exploit the advantages of a synergistic approach, it is important to first establish an equity and justice reference framework to judge the fairness and ambitions of the climate and SDG commitments.

Furthermore, unlike NDCs, SDGs are not actor-dependent, which makes it difficult to determine the accountability for SDG actions (Gjorgievski *et al*., 2022; Gusheva *et al*., 2022). NDC implementation is mostly overseen by environment ministries, while the 2030 Agenda was primarily the responsibility of more centralized cabinet-level organizations like the planning and finance ministries and the offices of the president or prime minister (Bouyé *et al*., 2018). Because each process has its own history, community of actors, and political dynamics, substantial difficulties emerge when trying to coordinate the two processes. In addition, the sheer number of international and national agreements, and goals, can overwhelm government planning processes, especially in the Global South (Bouyé *et al*., 2018). However, it could be argued that better coordination and system approaches across government agencies should lead to more effective and efficient use of limited resources and lead to better outcomes. Because of the isolated fashion in which the UNFCCC and United Nations Sustainable Development Group (UNSDG) operate, it has proven to be difficult to reconcile the two agendas, especially since the order of the policy cycles can vary. Therefore, aligning the policy cycles, as well as mainstreaming NDC-SDG targets under one institution, or establishing an enabling environment for cross-institutional knowledge sharing, and promotion of dialogues between the two organizations will be key to mitigating the limitations brought on by fragmented or unconsolidated policymaking and governance.

Economic barriers: One of the major barriers to exploiting synergetic opportunities is the flow of climate finance. In general, climate finance is inadequate for the current need; is unbalanced, in that more finance moves to higher income countries leaving the Global South under-resourced; and subject to the vagaries of global markets and events such as economic recession and the COVID-19 pandemic (UN 2022). The most current OECD figures put the total climate finance available at USD 79.6 billion in 2019 — roughly USD 20 billion shy of the target — despite affluent nations promising at COP15 in Copenhagen to mobilize USD 100 billion per year by 2020 to help mitigation and adaptation in developing countries. A further shortfall in the target was expected in 2020 due to COVID-19 (Marez *et al*., 2022). On the other hand, global defense spending rose by 3.7% in real terms in 2022 to reach a total of USD 2,240 billion. Europe's increase alone was 13% for the year. Over the last decade defense spending has increased by 19% (Tian *et al*., 2023). Shifting government spending priorities, especially in the short term, can impact the availability of finance for longer-term programs.

Moreover, the dedicated funding windows for climate action and SDGs create complexities in combining both agendas, resulting in multiplicities of funding streams advanced by specific priorities of investors. Nevertheless, both climate finance and ODA are inherently inadequate, and the poor understanding of the economic need to pursue synergies as well as the relationship between climate and development finance can further affect investment needs. For instance, developed economies, such as the G7 have largely failed to deliver financial pledges for a resilient and climate-neutral future (Matsushita *et al*., 2023). Initial cost barriers can prove prohibitive, for example, when determining whether to invest in energy-efficient or zero-emissions buildings. Similar cost concerns can also discourage investments in sanitary landfills or other waste treatment technologies that could potentially recover energy (Premakumara *et al*., 2018). Moreover, despite the advantages of lowering investment gaps by exploiting the synergies between climate action and SDGs, the two agendas inherently experience significantly large investment gaps. Investments would need to significantly increase to realize both goals and a synergistic approach can help improve financial flows. Particularly for the nations of the Global South that are both struggling to meet the SDG targets and are also experiencing the impacts of climate change firsthand; international adaptation flows need to be significantly expanded. Current flows are 5-10 times lower than the estimated needs and the gap is widening (UNEP, 2022a). Adaptation finance needs in the Global South could be around USD 202 billion/year by 2030.

Moreover, the lack of evidence on the economic need to pursue integrated mitigation and adaptation response options that can co-deliver across a range of SDGs with regard to the actual costs and benefits is problematic (Cavalett & Cherubini, 2018). There is also an inadequate understanding of the relationship between climate and development finance (Fischler *et al*., 2016); particularly, to what extent the synergies between the two might lower the individual financing gaps for climate action and SDGs, and whether there are positive and/or negative spillovers from their co-benefits which can further affect the investment needs. The most straightforward solution would be to establish new funding sources that address the two concomitantly or to bridge existing sources with the additionally imposed requirements of synergistic outlooks for both climate action and SDG progress. Finally, advancing the scientific knowledge across 'climate–development' research necessitates interdisciplinary perspectives, which is often difficult to justify to funders who focus on narrow academic fields and evaluate research excellence and risk accordingly (Fuso Nerini *et al*., 2019).

Confronting these barriers head-on is at least as important as demonstrating potential synergies in policy outcomes. Keeping these barriers and caveats in mind, it is necessary to apply a flexible and inclusive approach, adapted to the specific national institutional and historical context, to establishing mechanisms for coherent policymaking in order to gain acceptance and ownership for both the principle itself and its deployment.

To deliberately pursue synergies, the science-policy interface needs to be strengthened by overcoming the above barriers. There is a need to create an enabling environment to draw upon the advantages of synergies. In general, even though contextual factors like governance and institutional barriers can determine to what extent synergies can be utilized at national or sub-national levels, some learnings can be borrowed across boundaries (Winkler *et al*., 2022). For example, finance policies, long-term goals, and sustainable development objectives are some enablers applicable across various cases, particularly when integrated policy packages and numerous stakeholders are involved (Winkler *et al*., 2022).

2.2.6. Lessons learned

Since the adoption of the Paris Agreement and the 2030 Agenda, there has been a growing emphasis on synergies between climate and sustainable development. This heightened interest has followed the agreement over the need for even broader-based NDCs under the Paris Agreement. NDCs would include not only mitigation but also adaptation actions and offer more space for countries to make connections to broader development needs (Kainuma *et al*., 2017; Shawoo *et al*., 2020; TERI, 2017). It has also followed discussions in Article 6 over the creation and operationalization of the Sustainable Development Mechanism (SDM). Furthermore, the support for capturing synergies finds strong backing in the 2030 Agenda, as it presumed that sustainability hinged on taking an integrated, holistic approach to sustainable development that requires working across the multiple dimensions of sustainable development. The interest in synergies has also gained momentum from a series of conferences on climate and SDG synergies that began in Copenhagen in 2019 and one that was most recently held in Tokyo in 2022 (see Section 1).

The arguments for synergies are similar in some ways to co-benefits: harnessing can help offset the costs of climate action and bring climate finance to core development needs. At the same time, they arguably go beyond the somewhat static and limited scope of co-benefits. The notion of synergies tends to place a greater emphasis on dynamic feedback by actions that aim to address multiple development needs. It is also because the scope of those targeted goals tends to be greater — expanded beyond climate, air quality, health, and closely related concerns. It can also help appeal to a broader range of stakeholders and build the kind of political and economic support needed to break through barriers, lock-ins, and inertia to transformative change. Finally, it is because some of the synergy arguments also recognize and aim to account for the possible trade-offs or conflicts that can arise from pursuing a climate agenda in line with other development goals. These trade-offs can range from lost jobs when fossil-fuel industries are closed to harm to local ecosystems from climate-proofing infrastructure (UNFCCC *et al*., 2021).

Actions to draw upon the benefits of the synergies between climate action and SDGs are overall more evident in the countries of the Global South, such as in their attempts to consider interactions between NDCs and SDGs when formulating policies, and greater levels of explicit overlaps between NDCs and SDG targets. Moreover, best practices from these countries exhibit how they have established coordinated financial mechanisms or institutions to address both the 2030 Agenda and climate action simultaneously, such as in the form of combined budgeting for development and climate change agendas, mandatory incorporation of SDGs and climate action in ministries' annual business plans and financial budgeting, and complementary policies to mitigate the impacts of trade-offs on the social SDGs. Overall, there has been a lack of engagement from countries of the Global North to further synergize climate action and SDG targets because they have already exploited most of the synergies, are in a good position in terms of the progress made to SDGs and are primarily currently targeting climate action due to their focus on energy transition while maintaining economic productivity. Nevertheless, quantification, and particularly monetization, have been more evident for co-benefits in the Global North, as cost-effectiveness of policies is a major priority, whereas in the Global South, delivering across SDGs is a priority.

However, there has been an overall disconnect between modelling evidence and the utilization of synergies in policy and practice. This has been due to a wide range of technical and knowledge, political and institutional, and economic barriers, including unavailability of appropriate tools and technologies,

fragmented governance, and lack of coordination between institutions, and inadequate financing. To overcome those barriers, there is a need to build an enabling environment that actively encourages the integration of evidence into decision-making and follow-up actions. There is a mutual obligation between researchers of different disciplines and policymakers to strengthen their relationships to ensure the best scientifically verified policies are developed and implemented.

The NDC-SDG interlinkages, or the lack thereof, especially for SDGs that deal with poverty, education, inequalities, and justice, are illustrative of this lacuna. The UNFCCC process outcomes have so far failed to incorporate equitable climate action and finance mechanisms for adaptations, while the 2030 Agenda rarely includes explicit references to equity and long-term GHG emissions. Therefore, reconciling both agendas can ensure a just transition to zero-emissions and climate-resilient sustainable development (Fischler *et al*., 2016). To do so, there needs to be defined quantitative targets for SDGs under NDCs and vice versa, as well as enhanced reporting of LT-LEDS, which are currently severely lacking and thus hindering a just transition. Understanding the distributional effects of climate action is essential to designing comprehensive policies that leave no one behind. Lacking measures to mitigate the policies' distributional effects could worsen their effects on the poorest households.

While framed as global targets, there is a growing need to frame the progress and impacts of the 2030 Agenda and climate action at the local level to contextualize the synergies. A top-down approach that seeks to utilize cookie-cutter approaches to adopting measures across different countries and cities stifle the localization of climate change challenges, which are often shaped by local contexts such as the existing socio-political profiles and varying levels of economic development at the sub-continental or even the sub-national level (Schaeffer *et al*., 2014). Even at a city level, such as in Seattle, the impacts of the Mayors' Climate Protection Agreement were unevenly felt (Dierwechter & Wessells, 2013). In a similar vein, the Global Taskforce of Local and Regional Governments has highlighted that local governments have a key role to play in the realization of SDGs (Global Taskforce of Local and Regional Governments, 2018). SDG and climate action localization call for multi-stakeholder groups and processes, which demand awareness as well as the commitment and capacity to connect regional initiatives with global objectives.

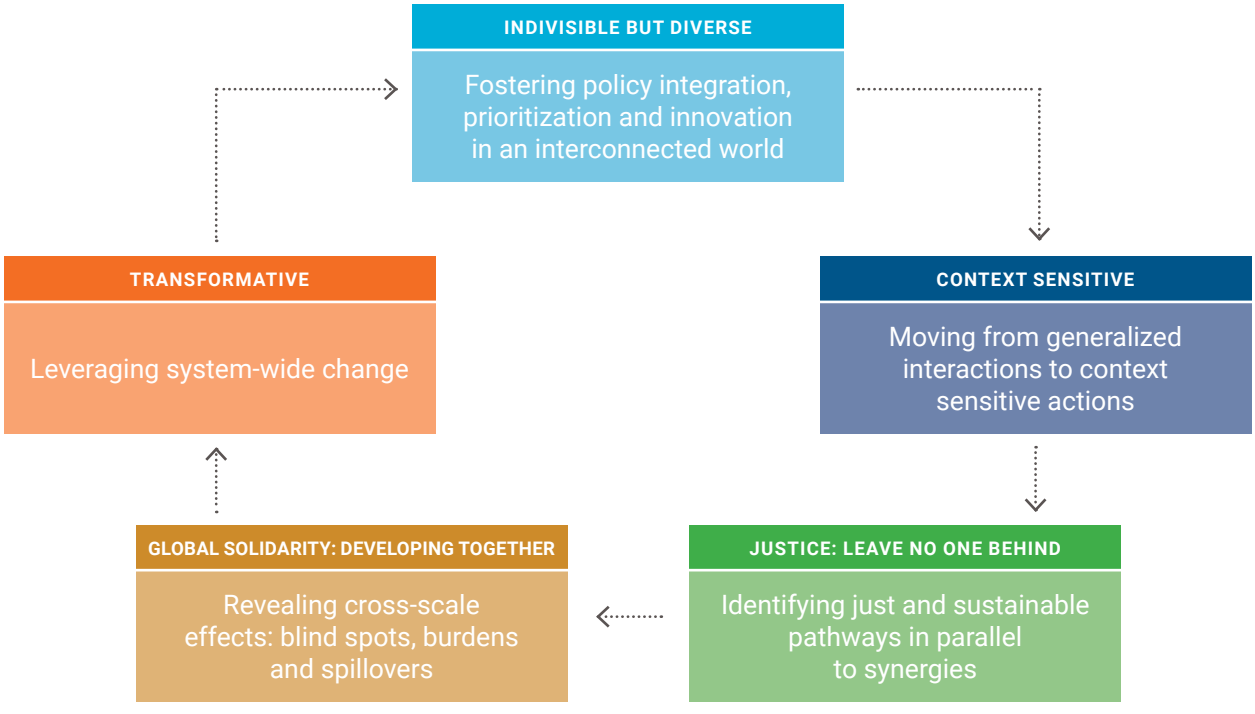
3. Increasing ambition on synergistic approaches: A framework for action

3.1 Rationale: why a framework for action?

Considering the dire lack of progress on both the Paris Agreement and the 2030 Agenda, we have reached a point where it is no longer feasible nor desirable to focus on achieving single SDGs without consideration of how this will advance, or hamper climate change objectives outlined in the Paris Agreement and vice versa. All sustainable development efforts must be embedded in efforts to ensure a safe, sustainable, and just climate system.

There are already a variety of approaches and tools that have been developed in the SDG arena that are useful and used for understanding and engaging with the interconnections between the SDGs and the Paris Agreement. We do not plan to develop yet another tool or approach but rather to offer a 'framework for action' that builds on several of these existing tools, evidence, experiences, and methods. This framework aims to offer public, private, and civil society actors working on sustainable development and climate action a structured approach to understanding and organizing complex information on the relevant interconnected social, technological, and ecological systems to support informed decisions, implementation, monitoring, and learning in ways that can maximize positive outcomes for both people and planet. It builds on, and links to, some of the existing tools that can assess the likely systemic effects of a planned action across social,

FIGURE 4. The five principles of the framework



environmental, and economic aspects. We highlight where there are gaps in the framework, where novel tools and approaches are needed to understand some of the impacts and consequences of these actions and point to potential avenues for developing some of these tools.

We aim to use this opportunity to move beyond a reliance on incremental improvements or adjustments made to changing external drivers (*e.g.*, the introduction of drought-tolerant crops for dealing with climate changes) or internal processes (*e.g.*, larger landfill sites for the waste of a growing city). Although such efforts can slow or mitigate the effects of these drivers, the system remains on the same development trajectory. These incremental efforts tend to dominate current sustainable development and climate change efforts. They do not address the root causes or the economic or political systems that created these problems in the first place, such as pollution or GHG emissions. Thus, the proposed framework focuses on pursuing the transformational or system-wide changes necessary to accelerate progress on the Paris Agreement and SDGs.

3.2 A framework for action – principles, tools, and synergies

The framework is based on core principles that are central to the 2030 Agenda and Paris Agreement and have been used across several case studies and evaluations of efforts to combat climate change and advance the SDGs (see studies in Section 2 of this report; Bennich *et al*., 2020; Olsson *et al*., 2020). These are an initial set of principles, they are not exhaustive but rather illustrative of what we have learnt so far in implementing sustainable development and climate policies in an interconnected, unequal, and unpredictable world.

Principle 1 – Indivisible but diverse: Fostering policy integration, prioritization, and innovation in an interconnected world

In recognition that SDGs are an interconnected but diverse system, several tools and approaches have been proposed to help identify positive/synergistic and negative/trade-off interactions between policy areas and targets (reviewed in Bennich *et al*., 2020). Several of these are available online, for example, the SDG Compass (Global Reporting Initiative (GRI), the UN Global Compact, and World Business Council for Sustainable Development (WBCSD)), and Integrated Reporting (International Integrated Reporting Council (IIRC)). A variety of methods ranging from qualitative scenario analysis to quantitative modelling have been used in these and other studies (Bennich *et al*., 2020).

The application of these tools and studies, which use systems, participatory, and inclusive approaches, offers a very important first step in the framework by helping to identify how best to work in an interconnected and coherent fashion between sectors and actors through the identification of groups of synergistic targets, policies, and sectors.

Most of these SDG interaction studies and projects have focused on creating greater policy integration and coherence which has been critical in the initial phases of the 2030 Agenda and Paris Agreement. Recently, as the implementation of these agreements progresses, the focus has begun to shift beyond integration, to pay attention to neglected areas such as prioritization (which policy areas, goals, actions, or actors will maximize progress) and innovation (the development of new policy measures or new uses of existing policy to truly foster coherence and integration). Both policy challenges (prioritization and innovation) are relevant when trying to map and act on climate and SDG synergies and are critical focus areas in the next phases of implementation of the Agenda 2030 and the Paris Agreement.

While most tools are generally applied to the SDGs only, they can be useful for identifying synergistic areas between the Paris Agreement and SDGs. For example, a recent application of a climate lens to SDG interactions (Dzebo & Shawoo, 2023) highlighted some highly synergistic global policy arenas that leverage both climate action and SDG achievement including scaling up climate and development finance and mainstreaming climate change for policy coherence.

Principle 2 – Context sensitive: Moving from generalized interactions to context sensitive actions

SDG interaction studies have also proven useful at contextualizing SDG interactions for a specific country, both at national and sub-national levels, or region. SDG and climate action interactions shape, and are shaped by, social-ecological context. A synergy between climate action and SDGs in one region can emerge as a trade-off in another. A selection of approaches and tools using systems and contextualized participatory approaches have proven particularly useful in identifying how certain groups of targets will interact in a particular context (Bennich *et al*., 2020).

One recent tool that brings these advances in systems approaches, contextualized understanding and participatory methods together is available online at the SDG Synergies website. SDG Synergies has been used to support coherent SDG implementation in Mongolia, Colombia, and Sri Lanka. While previously applied only to study SDG interactions, the tool may also be applied to analyze climate-SDG interactions. Other tools with a range of applications are also in development (Bennich *et al*., 2020).

While a useful step in prioritizing policy and sectoral focus, understanding synergies between targets and policy areas across different contexts does not necessarily lead to the identification of specific synergistic action and pathways needed to achieve those targets. Targets are an expression of a policy priority, making clear what needs to be achieved by when, but they do not specify the who, what, and how of process and action. The 2030 Agenda and Paris Agreement represent a compelling set of goals, objectives, and targets, yet as countries move ahead with implementation there is a need to move beyond the current focus of procedure and institutional arrangements needed to ensure integration and coherence to more substantive and specific strategies and actions.

In moving to action, acknowledging that there is no blueprint or generalizable action that will work and look the same everywhere and all the time, is key to the implementation of both climate and development agendas. However, some recent approaches go beyond the notion of context as idiosyncratic (i.e., context specificity) to instead identify local recurring contexts, that is, recognizable patterns of social-ecological relations, mechanisms, and the contexts under which specific actions are most likely to be effective or where certain SDG climate synergies or trade-offs are likely to exist (i.e., context sensitive). This application of the idea of recurring contexts has been useful in the global environmental change approach, which has been used in land use, climate change, and fisheries to identify a bundle of causal processes or drivers (often global in scale) leading to similar conditions for vulnerability across a diverse set of localities around the world (Crona *et al*., 2015). Such approaches are multi-sector and multi-scale and have proven useful in embracing the complexity of systems change, while at the same time moving towards a system understanding of the types of context sensitive interventions that might work (or the type of context sensitive SDG interactions that might hold) in certain types of contexts. For example: in one study exploring the impact of global market integration on 18 small-scale fisheries around the world (Crona *et al*., 2015), three main types of social-ecological syndrome/reoccurring contexts were identified: Syndrome A: healthy stock; Syndrome B: declining stocks and rising conflict; Syndrome C: declining stocks and elite wealth

accumulation. Fisheries identified as falling into Syndrome A were principally due to the presence of strong and well enforced institutions; fisheries in Syndrome B lacked these institutions and showed decreasing fishers' income, while Syndrome C fisheries had institutions, but they had been overwhelmed by other pressures such as strong demand from a powerful country and strong patron-client relationships. Each syndrome included fisheries on multiple continents suggesting that similar outcomes can be produced through common causal pathways across multiple contexts. The increasingly global nature of drivers of change such as trade can drive similar vulnerabilities in similar social-ecological contexts. This is useful in highlighting synergistic policy domains, dialog, and integration for small-scale fisheries linked to a particular syndrome.

Principle 3- Justice – leave no one behind: Identifying just and sustainable pathways in parallel to synergies

As pointed out by Leach *et al*. (2018) "It is no longer possible nor desirable to address the dual challenges of equity and sustainability separately". It is essential to keep in mind that the outcomes of any action, especially synergistic action with their potential for cascading effects, will be influenced by the distribution of current injustices, dynamics of marginalization, and power relations. For example, several synergistic action that foster a move to carbon neutrality in wealthy and powerful nations will depend on, and therefore disproportionately affect, resources and waste disposal sites in low- and middle-income countries (Olsson *et al*., 2020).

A focus on synergies alone to prioritize action, risks undermining justice as a core value and leaving vulnerable groups and regions often linked to less synergistic targets behind. Even for contextualized studies of SDG interactions, there will be cases where some groups will benefit from a synergistic action, and some groups may not benefit, or worse, may incur the risks and costs of that action. Studies of SDG and climate change interactions go beyond finding areas of 'best bang for your buck' to also show the potential for negative interactions and trade-offs and can be combined with approaches to disaggregate social groups and regions to study the potential for negative effects of synergistic action. SDG interaction studies have also highlighted areas of substantial and concerning negative impacts on specified targets, and therefore societal groups and sectors, should progress not be made in certain targets. For example, the study of SDG interactions from a climate change perspective highlighted the significant negative impacts of a lack of progress on SDGs and the Paris Agreement for reducing vulnerability, poverty, and inequality targets at a global level as well as within countries (Dzebo & Shawoo, 2023). If we only focus on areas of synergy in this framework, there is a risk that other target and policy areas identified as less synergistic will be neglected with the potential to undermine the 2030 Agenda and Paris Agreement.

Considering the current lack of progress on the climate and SDG agreements, studies of SDG and climate interactions must be used to highlight those targets and policy areas that require parallel and urgent attention. For example, a focus on targets such as poverty alleviation and addressing inequalities may not only fail to leverage immediate synergies with many other targets but also be disproportionately impacted by failures to achieve other SDGs and climate goals (Dzebo & Shawoo, 2023). Such evidence and studies must therefore be used to identify synergies and critical negative impacts on policy areas and targets ensuring no one is left behind — a key feature of this framework.

Finally, there is the need to explore justice implications of the means and pathways by which synergistic targets are achieved. Although there is consensus on the ultimate goals of the 2030 Agenda and the Paris Agreement, the means, or processes by which these goals are achieved are less agreed upon and will

likely differ across contexts. Usually, multiple, competing pathways are available to achieve a particular goal or policy target. Some of these pathways can be quite detrimental to the environment, equity, and the marginalized. Thus, target and policy areas related to equity, vulnerability, and democratic processes require parallel prioritization (Moore *et al*., 2014) supported by an evaluation process that directly examines both the end and the means of achieving this end. This requires any effort to identify synergies to be complemented by a parallel process to identify negative impacts and interactions to ensure the synergistic action and processes themselves are just and sustainable. While there are fewer tools available to explore some of these aspects, some online resources are becoming available for understanding the equity and sustainability consequences of particular actions, (*e.g.*, the Environmental Justice Atlas and the typology of equity and sustainability dynamics in Leach *et al*. (2018)).

Principle 4 – Global solidarity – working together: Revealing cross-scale effects: blindspots, burdens and spillovers

As studies of SDG synergies help to address the challenges of integrated and inclusive implementation, they have yet to help with another area not clarified in the 2030 Agenda — the potential for spillover effects and cross-scale interactions (Bennich *et al*., 2020). Frameworks for identifying SDG and climate interactions and synergies tend to treat the area or country of interest as a closed system with a non-porous boundary. This approach ignores the impact of external factors (*e.g.*, food prices), cross-scale interactions (*e.g.*, trade), and the very porous boundaries of the system of interest. This implies that external factors and cross-scale interactions often have a stronger impact on the country or area than internal factors. Some of the largest synergistic interactions or trade-offs may in fact lie outside of the area being assessed. This has been identified in studies of climate mitigation and the SDGs — where climate mitigation has powerful spillover synergistic effects in many countries across multiple SDGs (Roy *et al*., 2021). However, the most important mitigation efforts are often needed in countries, groups, and areas external to the context under consideration.

Similarly, by excluding other geographies and scales, synergistic interventions identified and implemented in one country could have significant negative effects on multiple SDGs and climate goals in neighboring regions or far distant places linked by spillover trade-off effects and cross-scale dynamics. Using frameworks that treat the system of interest as closed and isolated can undermine the effectiveness of synergistic action, and worse, they can result in burden shifting, erosion of resilience, and increases in vulnerability as has been seen from recent reviews of climate adaptation projects (Eriksen *et al*., 2021).

There is often a hidden assumption in SDG interaction and synergy frameworks that global progress is the sum of national, sector-specific progress. This is incorrect. In fact, progress in one country can undermine progress in multiple countries, ultimately resulting in a 'whole that is less than the sum of its parts'. For example, reforestation programs in one country with synergistic impacts on multiple SDGs and climate goals in that country, have been found to be cancelled out by the subsequent increase in trade-demand impacts of deforestation and cross-sector impacts in other countries (Downing *et al*., 2021). Current SDG interaction studies and frameworks need to better account for spillover effects and blindspots. This is an area requiring tool development and new approaches to account for these cross-scale effects.

Furthermore, several of these spillover effects and cross-scale interactions not only span spatial scales, but they can also span temporal scales, with impacts on the youth and future generations, for example, the impacts of not meeting the 1.5°C target, or the buildup of pollutants in a lake, or the health impacts of air pollution on children. Consideration of the synergies and trade-offs of actions in terms of future time

periods is vital and called for in recent briefs from the High Level Political Forum. Although policy and other implementation mechanisms are described, supporting intergenerational solidarity in frameworks for action will require new tools built on scientific and participatory approaches such as scenario planning, integrated assessment models, and other qualitative approaches.

There is an opportunity to build on existing tools by including cross-scale and cross-sectoral lenses, questions, expertise, and participants in these processes. Even simply mapping external factors relevant to areas of synergy, the potential spillover of prioritized synergies, or involving the youth and other diverse voices in such processes can be a good start. By treating the system boundary as porous and as a connector to other regions, rather than as an isolator, there is an opportunity to uphold the universal and international solidarity ambitions of the SDGs and the Paris Agreement and to identify cross-scale drivers of unsustainable and inequitable outcomes that require attention and policy focus if we are not to leave regions, generations, and groups behind.

Principle 5 – Transformative: Leveraging system-wide change

A set of potentially relevant studies and tools to help move from planning to action is provided by the growing body of evidence of the transformational (fundamental and system wide) changes required in the economic, political, and institutional structures creating the unsustainable and inequitable trends we see today. Transformative change is at the heart of the 2030 Agenda and is critical in any effort to achieve the Paris Agreement. Transformative change frameworks and approaches move the work of sustainable development beyond a reliance on incremental improvements to current technical, economic, and other systems to an understanding of where to engage in the system to leverage the desired system-wide changes needed.

With a growing literature and evidence base of synergistic policy areas (see Section 2 of this report) and accelerated progress moving to the implementation of sustainable development plans and actions by countries, it is timeous to link to approaches that advance systemic transformative change to identify, review and evaluate the potential of such synergistic action, to not only achieve multiple targets, but to set the world onto new trajectories of development for a more sustainable and equitable future.

In the 1990s, Donella Meadows proposed a hierarchical framework of system leverage points; proposing that some interventions are more likely to result in transformative changes, while others are shallower and only result in minor changes in a specific outcome. This notion of deep and shallow leverage points or interventions has resulted in the evolution of many 'leverage point' frameworks in sustainable development and climate change research and practice. One such framework — the three spheres of transformation — was developed specifically with the Paris Agreement in mind (Figure A5). This framework depicts three levels of action to achieve these goals: practical, political, and personal.

The Practical level includes the relatively technocratic parameters and resources or stocks often targeted by policy makers for climate change including new technologies (*e.g.*, renewable energy) and behavioral changes (*e.g.*, flying less, eating less meat). The second, deeper Political level focuses on the system and its structures — the interactions between elements in a system that drive the dynamics and sustainability outcomes, as well as the structures and institutions that manage those feedbacks and dynamics. This includes the regulations, norms, and institutions that govern how countries can respond to climate and sustainable development goals — often requiring innovation and redesign to facilitate the transformations required. The deepest level of leverage (Personal) includes the underlying world views, paradigms, mental

models, and values that determine a system's direction and trajectory. By broadening the inclusivity and diversity of views and values at this level, system-wide progress is enhanced. For example, moving from instrumental values (*e.g.*, monetary value of pollinators to agriculture) to relational values (*e.g.*, place attachment and care for nature) has been shown to enhance sustainable development policy in the EU and has been central to the work of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Mattijssen *et al*., 2020).

Using this, or similar leverage point frameworks (see Figure A6), to complement the process of identifying SDG-climate synergies is essential as one moves from synergistic areas to specific interventions for implementation. The shallower points of intervention are often more appealing as they are often easier and may have faster results, however, deeper levels of action, while challenging to implement, have the potential to effect system-wide change and to transcend scales helping address current challenges experienced with scaling and advancing synergistic action from case studies to system-wide changes.

For example, a review of interventions to promote the sustainability of food and energy systems, often identified as key synergistic areas of intervention to climate change and the SDGs, were found to mostly target the shallower levels, for example, to increase efficiency ratios and on optimizing numbers and parameters (Dorninger *et al*., 2020). But such interventions alone are unlikely to result in system-wide change because key system characteristics, feedback, and power relations remain unchanged. In these cases, we see impacts such as 'rebound effects' hampering efficiency efforts, or the deferring of impacts to other places or generations or groups, or decreases in diversity and redundancy through optimization efforts, leading to increases in vulnerability under changing conditions. Such interventions are said to treat the symptoms and not the causes of the sustainability and climate change challenges. At best they can be limited in their effectiveness, at worst they can lead to further locks ins (*e.g.*, persistent poverty) and pathologies (entrenched marginalization dynamics) that they were supposed to address in the first place.

The review assessed the transformative potential of common interventions in food and energy systems and found that it is common to focus on the more tangible and relatively easy to conceive parameters such as taxes, incentives, and physical inputs. Increasingly there is a suite of interventions in these systems that go deeper into intervening in the system design and political levels including restructuring information flows, rules, power structures, and innovations in institutions with more lasting and system-wide impacts. They highlight key gaps for deeper interventions in the system structures by changing or strengthening feedback loops (*e.g.*, the reconnection of human activities to natural cycles). Actions and interventions at the deeper level of values, worldviews, and paradigms were very rare but showed the potential to ultimately shape those systems.

At this deep level of transformative potential, a focus on changing the goal of the system has been shown to be a key synergistic opportunity — triggering system-wide change and addressing multiple goals and targets. For example, in a three-year project to identify actions for the tourism sector to reduce climate change risks, seven leverage points for action were identified (see Figure A7) (Loehr & Becken, 2023). Of these, one of the deeper points of engagement involved redefining the goals of the tourism system from a narrow focus on economic outcomes to rather focus on the wider sustainability and resilience outcomes to which it contributes (*e.g.*, national emissions reduction targets, biodiversity conservation, an increase in equity and equality, education, and health). The opportunities for synergistic outcomes of such a shift in goal and outcomes are system wide and therefore transformational.

In the example of food and energy systems, clarifying and redefining the goals of these systems to align with the priorities of the SDGs and the Paris Agreement has high transformative potential. For example, there are many calls to shift from a narrow focus on food or energy security to wider goals encompassing the health, justice, and sustainability of these systems. Developing indicators for food and energy systems linked to these redefined goals and measuring their contribution to those goals can be transformational and essential in achieving multiple synergies and interactions between climate and sustainable development goals.

3.3 A framework for action founded on core values and principles

This framework moves from a focus on policy and target synergies, through to systemic and participatory tools and methods that can make sense of complex social, environmental, and economic information to clarify the intended and unintended outcomes of specific actions. It combines innovations in SDG interaction studies with tools and knowledge on the interconnections between countries, scales, time frames, and equity and sustainability to highlight the potential for positive outcomes for people and the planet, the potential for positive and negative spillover effects, and the disproportionate impacts on vulnerable people and places, many of which are current blind spots in synergistic efforts and frameworks.

The framework also offers practical insights on leverage points and transformative potential to cluster, prioritize, and deepen the resultant sets of synergies and synergistic action. This will move beyond efforts that currently focus on the tangible and easy to measure. It will ensure that these useful interventions are complemented by actions that foster systemic changes able to transcend scales thereby addressing the current 'sustainability gap' — the gap between the transformative ambitions of the SDGs and Paris Agreement, and the inability of current interventions to generate system-wide change.

The role of core values and principles in shaping any framework for action is critical. This framework brings in five principles relevant to sustainable development and climate action. There are of course many more. Ultimately studies and projects to identify synergistic action to achieve SDGs and climate change are determined by the perspective of the team working on the problem (Bennich *et al*., 2020). This shapes what is identified as the sustainability problem to be addressed, the level at which that problem resides in a leverage framework, and ultimately the actions prioritized. In a review, such problem framing was found to influence the final suite of interventions identified and their transformative potential. When a sustainability problem is seen as technological or from an engineering perspective mostly shallow actions are proposed, but when viewed as a social, ecological, political, or economic problem actions tend to focus on the system structures and goals to a great extent (Mattijssen *et al*., 2020). Similarly, a focus on these deeper levels of system design tends to include synergistic outcomes ensuring more collaboration and equality.

While acknowledging the importance of perspective on the results of synergistic assessment, no single perspective is correct or more valuable. What appears more important is the inclusion of multiple perspectives and problem frames. When diverse views on the problem are sourced, interventions tend to occupy multiple levels of leverage but more importantly understanding of the interactions between these levels of interventions can be promoted — linked to great policy coherence and the indivisibility at the heart of the SDGs.

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5. Appendix

5.1 Figures

FIGURE A-1. Near-term adaptation and mitigation actions have more synergies than trade-offs with Sustainable Goals (SDGs). (Source: IPCC Synthesis Report 2023. https://www.ipcc.ch/report/ar6/syr/figures/figure-4-5).

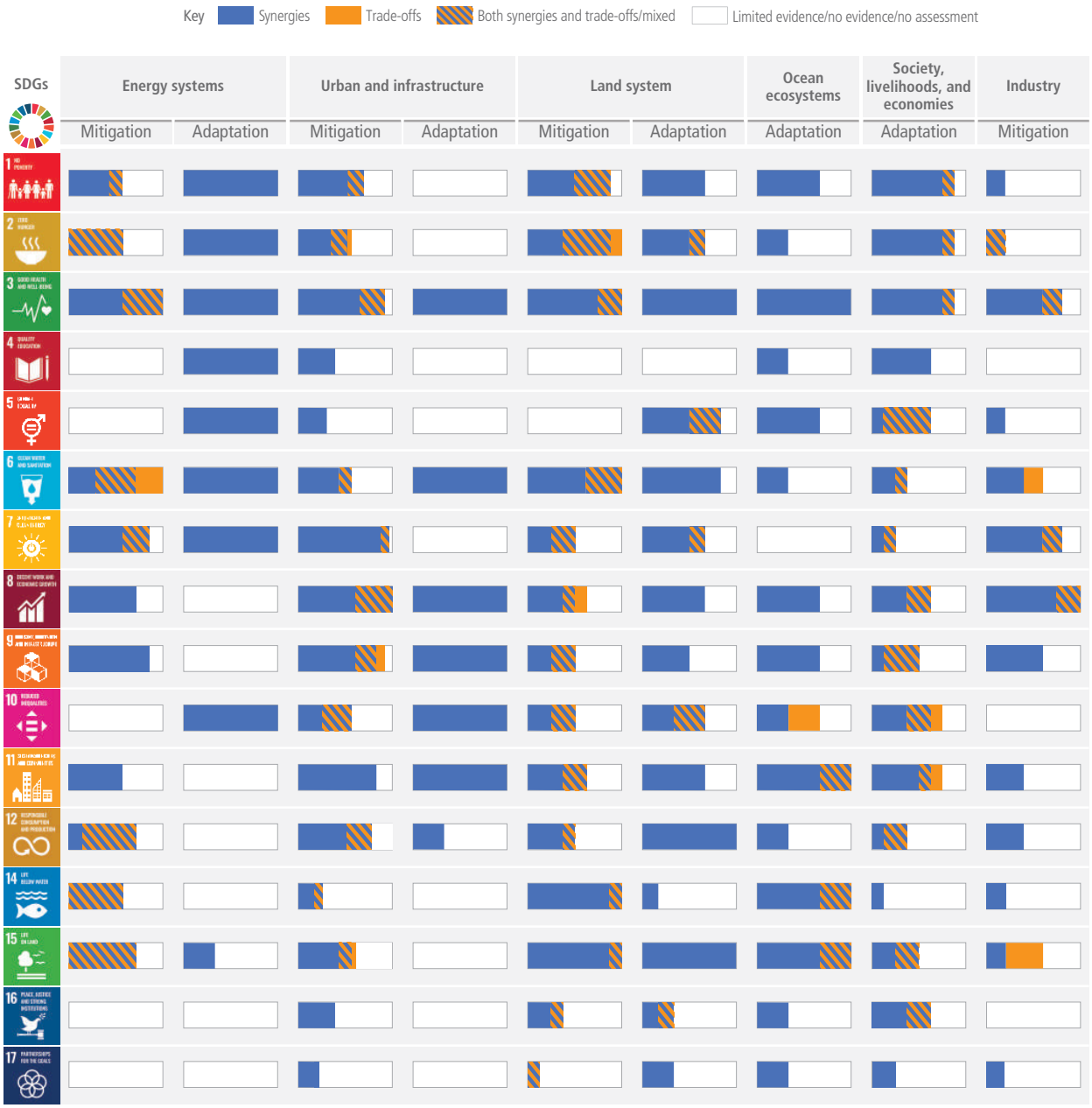


FIGURE A-2. Change in number and share of NDC activities in 63 first and updated submissions (Dzebo *et al*., 2023)

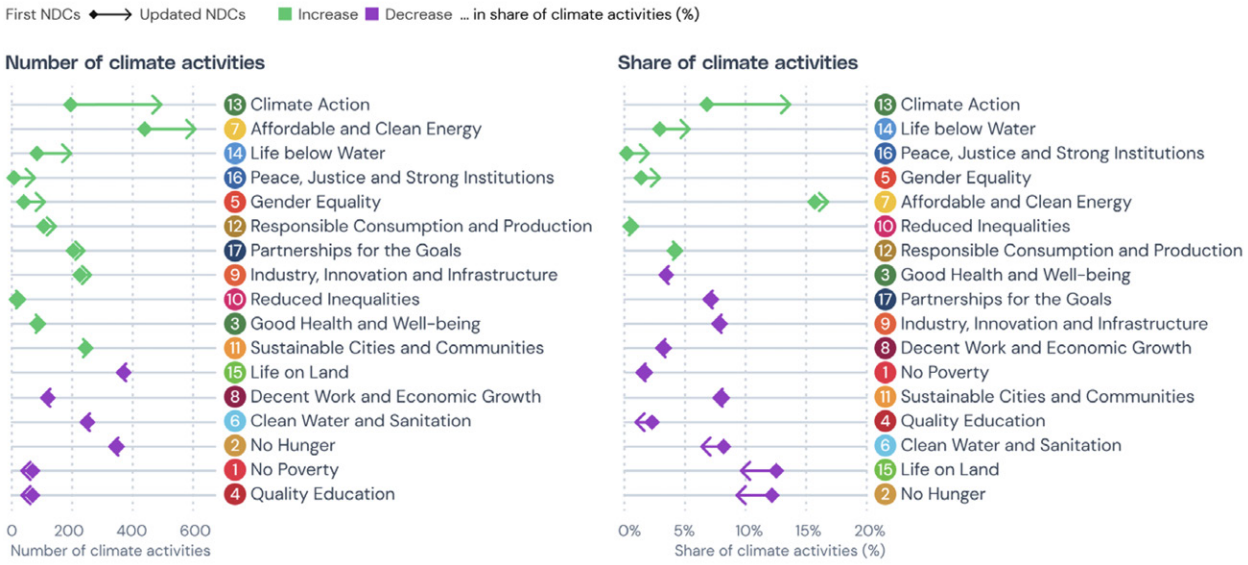


FIGURE A-3. Change in the share of activities for Goal 7 (Dzebo *et al*., 2023)

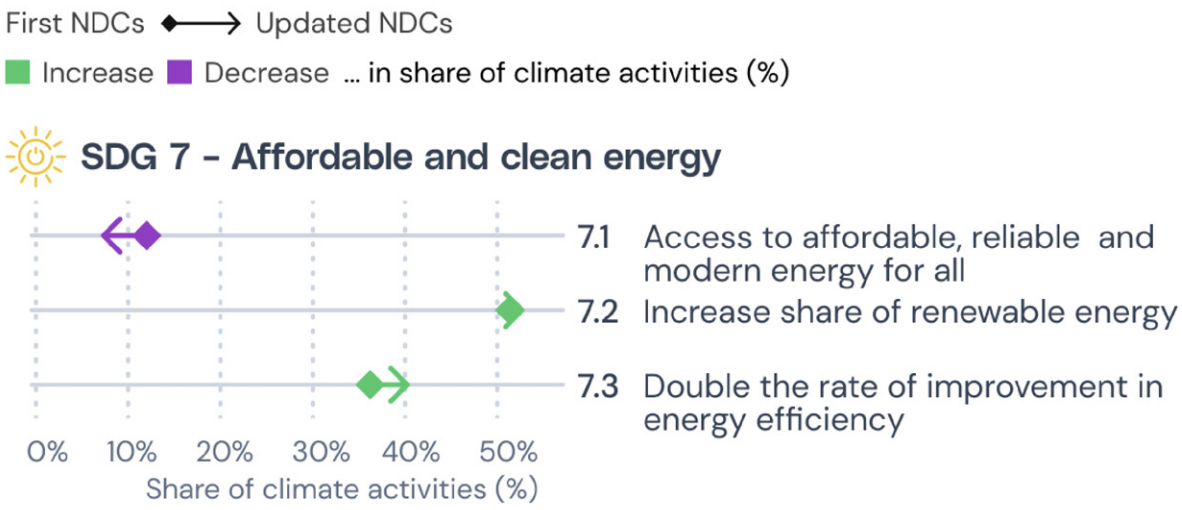


FIGURE A-4. Climate finance provided and mobilised across regions and income groups in 2016-2020 (OECD, 2022).

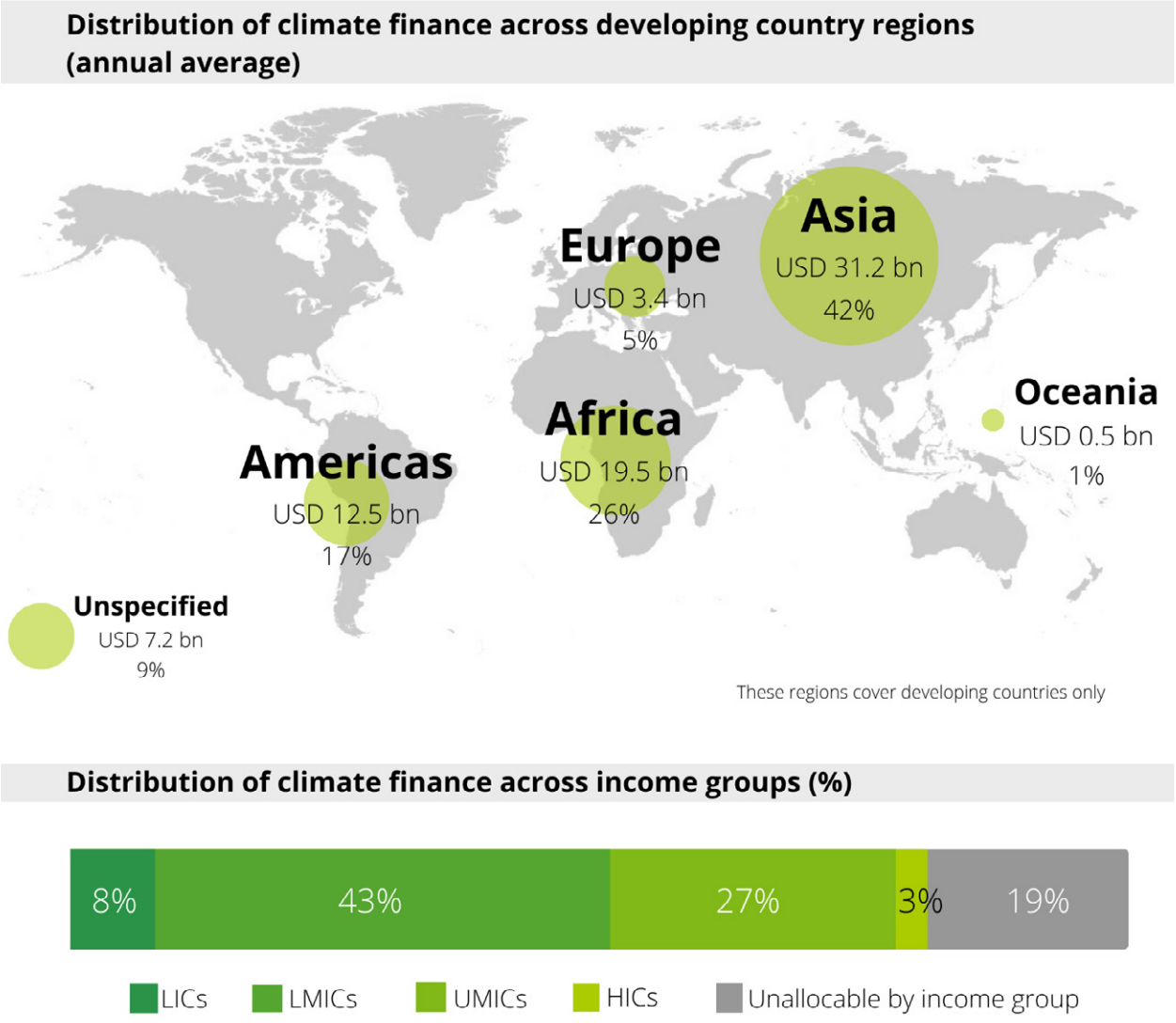


FIGURE A-5. The three spheres depict the dynamic relationships between the practical, political and personal dimensions of transformation. They draw attention to the importance of the political and personal spheres in generating the conditions for practical transformations that contribute to the 1.5°C target. (Extracted from O'Brien (2018)).

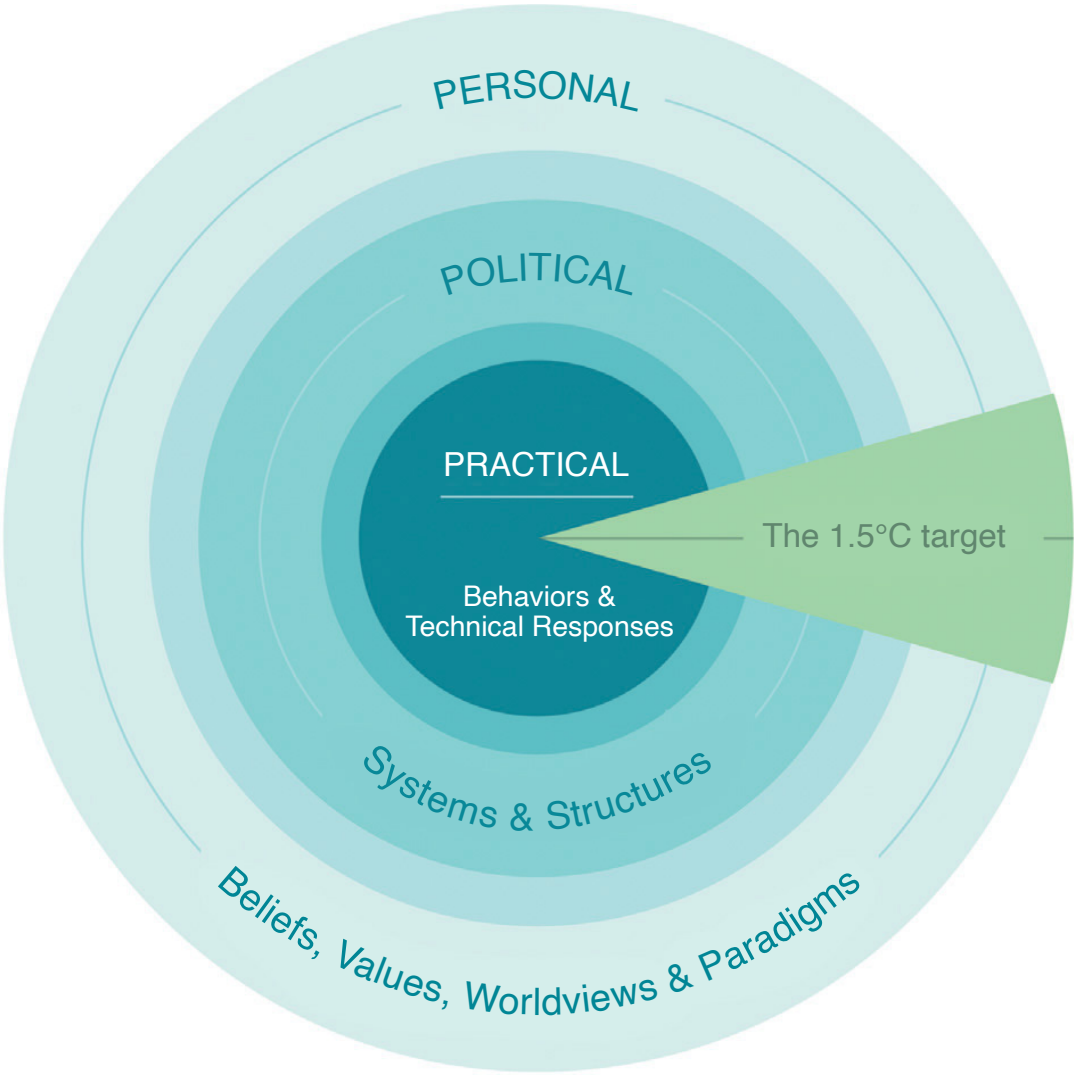


FIGURE A-6. The iceberg model demonstrates that it is most effective to intervene more deeply within our system. Working above the water line will not address the underlying patterns, processes and systemic structures that enable us to adapt and transform. It may take time and be harder to implement, but deep adaptation and transformation provides stronger potential to respond positively in the face of change. (Extracted from the Goulburn Murray Resilience Strategy 2020. The Goulburn Regional Partnership, Government of Victoria, Australia).

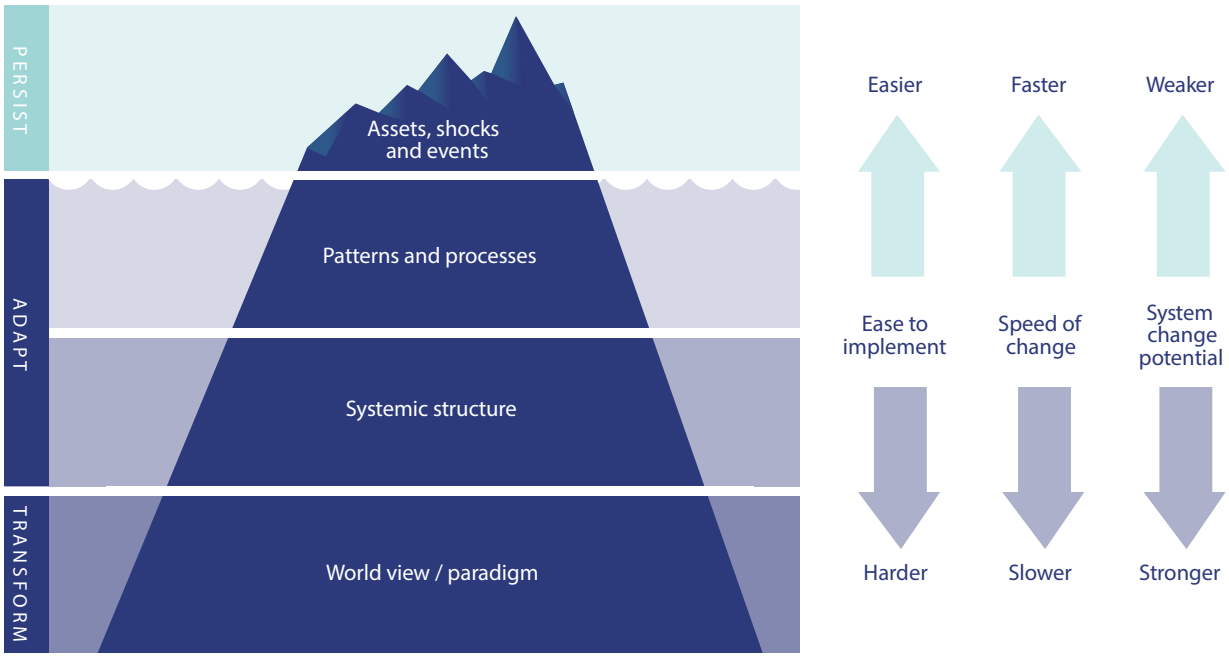
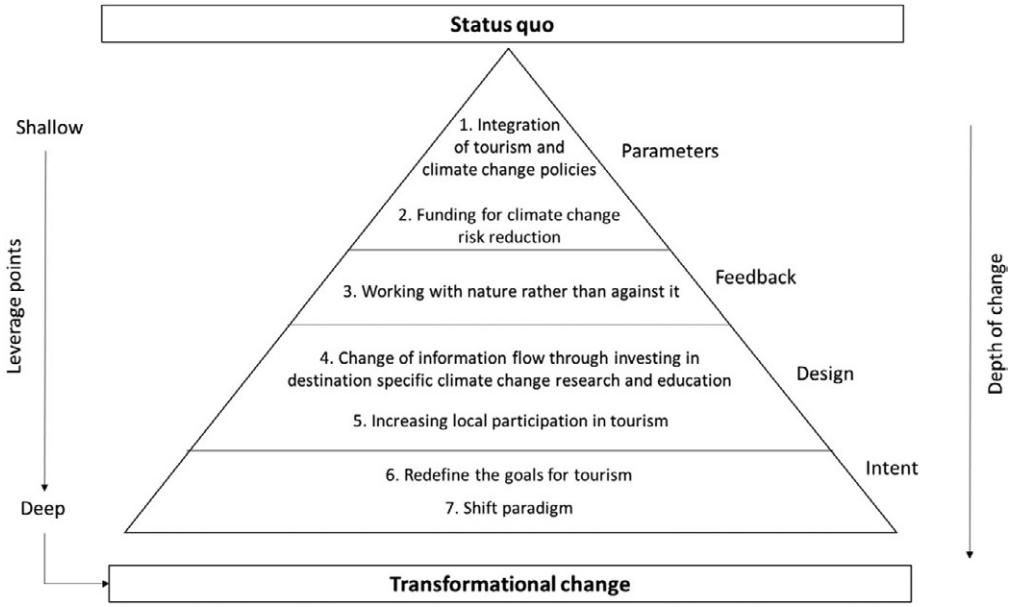


FIGURE A-7. Leverage points for climate risk reduction in Vanuatu destinations and level of change required to implement them. (Source: Extracted from Loehr & Becken (2023).



5.2 Tables

TABLE A-1. Climate change action and SDG synergies: Case study examples

SDG	Number (%) of NDC activities globally that relate to the SDG	Example of co-benefit(s) between climate action and SDG	Example case study	Reference
1. No poverty	155 (1.9)	Implementing urban poverty reduction programs that integrate climate resilience and low-carbon development can improve the living conditions and livelihoods of the urban poor, while also reducing emissions and enhancing adaptive capacity.	In Ahmedabad, India, the Slum Networking Project has provided basic services such as water supply, sanitation, drainage, solid waste management, street lighting, and paved roads to over 100,000 slum dwellers, while also promoting low-carbon solutions such as biogas plants, solar panels, and rooftop gardens.	Thema *et al*., 2019
2. No Hunger	929 (11.4)	Promoting urban agriculture and food systems that are climate-smart and sustainable can increase food security and nutrition, while also reducing emissions and enhancing adaptation.	In Rosario, Argentina, the Urban Agriculture Program has supported hundreds of urban farmers to produce organic food in vacant lots, rooftops, and public spaces, while also providing training, technical assistance, and marketing support.	Maassen & Galvin, 2021
3. Good health and wellbeing	260 (3.2)	Improving urban air quality and health through low-emission transport and energy policies can reduce greenhouse gas emissions and associated health risks, while also enhancing mobility and wellbeing.	In Bogotá, Colombia, the TransMilenio Bus Rapid Transit system has reduced travel times, costs, accidents, and emissions by providing high-capacity buses that run on dedicated lanes along with cycling and pedestrian infrastructure.	Labriet *et al*., 2009; Yüce & Babalik-Sutcliffe, 2012
4. Quality education	188 (2.3)	Enhancing climate change education and awareness in urban settings can foster behavioral change and empower individuals and communities to act for mitigation and adaptation.	In New York City, USA, the Climate Change Education Project has integrated climate change into the curriculum of over 600 public schools, reaching over 1.1 million students with learning activities such as school gardens, green roofs, and energy audits.	
5. Gender equality	93 (1.1)	Mainstreaming gender equality and women's empowerment into urban climate policies and actions can ensure that women's needs, roles, and capacities are recognized and addressed, while also enhancing their participation and leadership in decision-making.	In Quito, the Gender Inclusive Cities Program has supported women's groups to conduct safety audits, raise awareness, and advocate for gender-responsive urban planning and climate action.	
6. Clean water and sanitation	724 (8.9)	People are always in danger of cholera and other waterborne illnesses if they do not have access to clean water. This hazard is being exacerbated by climate change. More frequent flooding of sewage systems contaminates nearby water supplies and the environment. People are forced to use less sanitary sources of drinking water by severe droughts. Additionally, there is a higher chance of other health effects.	Through the Water, Sanitation, and Hygiene (WASH) program, the Department for International Development (DFID) in the UK gave 62.9 million people access to clean water, fundamental sanitation, and hygiene promotion. Through the Sanitation, Water and Hygiene for the Rural Poor program (2017–2022), it also engaged in a £57.3 million cooperation with UNICEF, the United Nations Children's Fund, to offer sustainable WASH services to 3.8 million people in 10 countries.	Independent Comission for Aid Impact, 2022

SDG	Number (%) of NDC activities globally that relate to the SDG	Example of co-benefit(s) between climate action and SDG	Example case study	Reference
7. Affordable and clean energy	1375 (16.9)	Solar systems help not only connect small communities that are detached from national electricity grids, thereby allowing users to pursue productive activities such as education and employment but also represent a sustainable energy solution, helping avoid carbon emissions produced during the combustion of fuelwood.	In rural parts of Southern Belize, three Mayan women, trained by Barefoot College India, are installing solar systems, in four indigenous communities impacting over 1,000 residents, and helping avoid 6.5 t of carbon emissions. In the Graham Creek village, they powered 25 homes benefiting over 150 residents, as well as a primary school with 30 children.	UN News, 2022
8. Decent work and economic growth	322 (4.0)	The move towards a net-zero energy system is essential to limit the global warming potential within 1.5°C. The process of transition towards the renewable energy sector will have a significant impact on the job market by creating more green and decent jobs while enhancing economic growth.	More than 5.8 million of the 9.8 million workers employed in the renewable energy sector are now concentrated in the Asia-Pacific region, (with 40% in China and about 9% in India). Employment in the sector will increase, resulting in a net gain in job possibilities that will exceed losses in traditional energy industries like coal. According to ILO projections, this region might create 14.2 million jobs by 2030.	LO, 2017
9. Industry, innovation, and infrastructure	540 (6.6)	The development of resilience and more effective use of natural resources can be greatly aided by the construction of new, greener infrastructure, the retrofitting or reconfiguration of existing infrastructure systems, and the use of smart technologies to their full potential.	The Olkaria power station in Kenya is a geothermal investment venture created to lessen the nation's dependency on hydropower. According to the World Bank, Olkaria has boosted the share of geothermal energy in Kenya's national energy mix to 51%. Geothermal energy is essential to Kenya's plan for reducing poverty by boosting access to dependable and clean electricity.	UN Regional Information Centre for Western Europe, 2022
10. Reduce inequality	30 (0.4)	Climate change and increases in natural disasters exacerbate already existing inequities within and across nations by disproportionately harming the poorest and most vulnerable people. Thus, a policy or action needs to aim at tackling both the impacts of climate change while reducing inequalities.	In Rosario, Argentina, with the help of the urban agriculture program, low-income citizens may plant food on underused public property. Seven regional farmers markets now sell the fruits and vegetables grown on more than 75 ha of land that have been transformed into gardens giving poor locals a new source of income. Additionally, it aids in reducing the impact of urban heat and strengthening the city's flood resistance.	Galvin & Maassen, 2020

SDG	Number (%) of NDC activities globally that relate to the SDG	Example of co-benefit(s) between climate action and SDG	Example case study	Reference
11. Sustainable cities and communities	751 (9.2)	Building resilient communities and economies, secure and affordable housing, and career and business possibilities are all necessary components of sustainable city development. Investments in public transportation, the development of green public areas, and enhanced urban planning and administration using inclusive and participatory methods are required.	In London, UK, low-income groups, and those who have traditionally been marginalized are least likely to possess vehicles yet are most likely to breathe polluted air. Children, immigrants, and people of color often experience air pollution that is 16% worse than normal, even though over 95% of inhabitants are exposed to unlawful and harmful air pollution. Thus, in 2019, London introduced the first Ultra Low Emission Zone where all drivers are now required to adhere to rigorous vehicle emissions requirements in the 21 km^2 of central London, or else pay a fee. The fee's proceeds are subsequently reinvested into the city's public transportation infrastructure. In the first 10 months, the strategy resulted in a 44% decrease in roadside NO_2 with 44,000 fewer polluting automobiles per day in the city.	Galvin & Maassen, 2020
12. Responsible consumption and production	293 (3.6)	The livelihoods of the present and future generations must be sustained by ensuring sustainable consumption and production patterns. The triple global catastrophes of climate change, biodiversity loss, and pollution are all caused by unsustainable patterns of production and consumption.	The EU economy expanded by 6.3% between 2016 and 2021, whilst domestic material consumption (DMC) expanded at a slower rate, 4.5%. As a result, the resource productivity of the EU rose by 1.4%, from €2.06/kg of DMC in 2016 to €2.09/kg in 2021. Simultaneously, due to greater reductions in energy consumption than in material usage, energy productivity of EU between 2016 and 2021 increased by 9.1%, from €7.8/kg of oil equivalent (kgoe) to €8.5 /kgoe. EU's 6.3% economic growth during that same period was matched by a 2.6% drop in gross available energy (GAE).	Eurostat, 2023
13. Climate action	629 (7.7)	The focus on helping marginalized groups, such as displaced and indigenous populations, and particularly women, helps deliver many social SDGs due to empowerment and reduced inequalities. At the same time, training such communities to take up, not only sustainable sources of income, but also livelihoods that are able to restore sensitive native species and promote forestation can help advance emission reductions.	Under the women-led project Amazonas Originaria, a group of displaced indigenous families are being taught how to utilize and take care of the tropical woods close to Puerto Ayacucho. They are learning how to cultivate the native Amazonian plants cacao, cupuaçu, manaca, and tpiro and how to turn their fruits into pulp, chocolates, baskets, and other goods. This project seeks to rehabilitate portions of the degraded tropical forest by replanting native trees and other species. It also trains community people to create Amazon-derived items and ecological packaging, assisting them in diversifying their incomes	UN News, 2022

SDG	Number (%) of NDC activities globally that relate to the SDG	Example of co-benefit(s) between climate action and SDG	Example case study	Reference
14. Life below water	256 (3.1)	Research and conservation strategies that account for how species populations may vary due to the impacts of climate change are important for a sustained repopulation of at-risk organisms. Moreover, inclusion of local communities also helps induce a sense of ownership of the natural resources within the communities and helps them pursue sustainable income sources.	The Barbados Sea Turtle Project, housed at the University of West Indies' Campus, is helping inform the conservation strategies for the Hawksbill turtle, classified as endangered by the IUCN due to its vulnerabilities to heatwaves, and other anthropogenic factors. Under this project, turtles may be tracked using tags, which also allow researchers and conservationists to estimate growth rates, survival rates, and reproductive output. The project managers also assist local communities in promoting ecotourism using best practices, which gives them a source of income.	UN News, 2022
15. Life on land	1025 (12.6)	Action measures aimed at controlling or reducing pressures on the paramo and mitigating negative actions by extractive activities in the area help communities undertake more sustainable livelihoods, while the establishment of conservation areas, and measures to reduce risks associated with climate change improve advances made in climate action.	The GEF Small Grants Program and two other organizations have formed an alliance called Guardianas de los Páramos (Paramos Women Guardians) to support several local projects aimed at protecting the environment and preparing for climate change in the Paramos Pisba and TotaBijagual-Mamapacha. A total of 37 projects were chosen, helping 2,400 people who had been restoring native plants since 2020 to maintain protected areas and strengthen biological corridors. Aqueduct modifications and the use of homegrown agroecological gardens are also part of the projects, which aim to lessen the need for environmentally damaging traditional production methods. The alliance places a special emphasis on women's engagement because historically, inequality and unequal access to resources have reduced the involvement of women in environmental management.	UN News, 2022
16. Peace, justice, and strong institutions	32 (0.4)			
17. Partnerships for the Goals	537 (6.6)	Only through effective international collaboration and partnerships can the SDGs be achieved. At USD 147 billion in 2017, official development assistance remained constant but fell short of expectations. Conflict- or disaster-related humanitarian problems continue to necessitate increased funding and assistance.	The UK is supporting a new initiative on 'Near-Zero Emissions Coal' with Carbon Capture and Storage (CCS) to address the challenge of tackling rising greenhouse gas (GHG) emissions from the use of coal in China as a key component of the EU-China Partnership, signed in Beijing on September 5, 2005. This is done in consideration of the fact that by 2030, CO_2 emissions from China's growing coal consumption will have doubled to more than 5,000 Mt. With the use of carbon capture and storage, emissions per unit of power might be cut by 85–90%. By 2030, anticipated emissions in China might be cut in half thanks to the widespread use of 'Near-Zero Emissions Coal' and CCS.	Sabapathy, 2007

Source: NDC and SDG number of actions data obtained from https://klimalog.idos-research.de/ndc-sdg/

TABLE A-2. Some examples of climate finance tools enhancing synergies between climate change mitigation, adaptation, and SDGs co-benefits.

Climate instrument	Coverage	Example of synergy	Reference
Air quality development funds	Global	More than 70% (USD 7.6 billion) of air quality funding successfully addressed climate change due to energy and transportation sector mitigation measures.	Clean Air Fund, 2022
IDFC Green Climate Commitment	Global	Pledged USD 224 billion in green finance, half of which will be channeled to climate finance to be used for mitigation, and adaptation measures, such as renewable technologies, and adaptations to improve coastal protection, agricultural resilience, and water security.	Climate Policy Initiative, 2022
Climate Resilient Green Economy (CRGE)	National (Ethiopia)	Plan encouraging economic growth that is resilient to climate change and follows a low-emissions pathway.	Gomez-Echeverri, 2018
Clean Cooking Fund, World Bank's Energy Sector Management Assistance Program	Global	Announced in 2019, the Fund has targeted USD 500 million and plans to reach USD 2 billion in total commitments by leveraging private finance through the World Bank's lending operations, such as the Netherlands, Norway, and the United Kingdom. It accounts for gender-equitable outcomes such as time savings from fuel extraction and the impacts of inclusive labor forces. It has also recently invested USD 56 million in the development of alternative stove and fuel technologies and finance methods to increase clean cookstove access. The Rwanda Energy Access and Quality Improvement Project (EAQIP) will be financed by the Clean Cooking Fund, which has committed USD 20 million with the International Development Association (IDA) with the aim of granting access to clean cookstoves to more than 500,000 people in Rwanda. In countries with historically low clean cooking financing, such as Burundi, Ghana, Mozambique, Myanmar, Niger, and Uganda, future projects are being planned.	Climate Policy Initiative, 2021
(Climate related) ODA	Recipient countries	Donors' climate-relevant funding supports numerous SDGs (2, 6, 7, 11 & 15).	Iacobuţă *et al.*, 2022
Financing Locally Led Climate Action program (FLLoCA)	Kenya	The World Bank is collaborating with the federal, state, and municipal governments (SDG17) to direct funding and decision-making for climate change to residents to develop solutions that address their unique needs. To analyze climate threats and provide socially inclusive solutions that are suited to local needs and goals (SDG10, 13) county governments are given help through FLLoCA. The FLLoCA Programme in Kenya is the first replicable national-scale example of devolved climate funding in the world.	World Bank Group, n.d.
National community-driven development (CDD) program	Philippines	The National CDD Program served as the conduit through which the Bank provided recovery assistance in the Philippines during Typhoon Yolanda so that local communities could direct the decision-making process: The DAMPA (Damayan ng Maralitang Pilipinong Api) network is made up of more than 200 community-based organizations run by women that represent the disadvantaged populations in the Philippines' rural and urban areas. Following Typhoon Haiyan, it collaborated with the government to track the distribution of disaster relief aid and supported community-based risk mapping to guide the National CDD Program's prioritization and design of community-level initiatives.	World Bank Group, n.d.
Green Bonds	Global	Iberdrola, the first Spanish company to issue a green bond company, signed new green or sustainable deals for a total of €13.1 B to make a total of €35.8 B in green and sustainable funding like investments in Mexico and the UK, mostly onshore wind farms.	Iberdola Group, n.d.

Climate instrument	Coverage	Example of synergy	Reference
Peace Renewable Energy Certificates (P-REC) Aggregation Fund	Sub-Saharan Africa	The Peace Renewable Energy Certificates (P-REC) Aggregation Fund is a unique financial tool that enables project developers to generate additional income that they can utilize to secure further funding by monetizing the unbundled environmental benefits of renewable energy. The P-REC fund capitalizes on the expanding voluntary market for certifications with energy attributes. P-REC will help catalyze additional investments for renewable energy plants, with the capacity to avoid approximately 658,000 tCO_2 emissions. Additionally, this fund will generate 9,900 direct jobs while improving the air quality by displacing fossil fuels such as kerosene and diesel.	Chiriac *et al*., 2021
Smallholder Resilience Fund (SRF)	Sub-Saharan Africa	The Smallholder Resilience Fund (SRF) was created to concurrently address many market failures. SRF will increase the ability of current SMEs by offering financing across whole value chains to buy, process, and export high value produce at scale. This is done via a synchronized investment method. The 'venture studio' of the SRF will locate value chain gaps and assist in starting and growing new SMEs focused on farmers into venture-ready enterprises. Diversifying smallholders' income sources using climate-smart crops rather than monoculture would enhance climate resistance and adaptation.	Mazza & Blocher, 2021
The Fund for Nature (TFFN)	Sub-Saharan Africa	TFFN offers project-level debt backed by standardized, bankable offtake agreements to address the rising demand from corporate off takers for high-quality nature-based carbon projects. TFFN seeks to enhance the supply while also boosting the financial gain for project implementers and local communities. This instrument is estimated to save 2t CO2 per hectare per year for avoided emissions and 10t CO2 per hectare per year for removal, over 30–50 years. Additionally, TFFN employs a gender-sensitive perspective to give priority to initiatives that guarantee women are equitably represented and gain from project conception and execution. 50% of new occupations are predicted to be held by women.	Lonsdale & Azhar, 2022
Emissions trading schemes (ETS)	Global	As of 2018, 25 ETSs had been established in subnational jurisdictions. Federal structures are common in nations like the US and Canada, giving the provinces the freedom to adopt pricing programs as they see fit. For instance, a carbon taxing program of CAD 20/tCO2e was implemented in 2017 in the Alberta area of Canada on varieties of fossil fuels, such as different liquid, solid, and gaseous fuels, as well as combustible waste. From 2018, the carbon tax rate is CAD 30/tCO2e, and the revenues from carbon tax are used to fund new green programs.	Ramstein *et al*., 2018.
Adaptation Fund	Global	There is a regional window of opportunity focused on regional/ transboundary projects under the Adaptation Fund covering 20% of all funding. Also, about 13% of all resources of the Adaptation Fund are allocated to water management. Water projects include energy, ecosystems, and biodiversity components. Thus, the Adaptation Fund helps to support climate action consistent with such SDGs as 6 as well as 7, 14,15, and 17.	Adaptation Fund, 2022
GEF: International Waters	Global	GEF: International Waters supports projects in transboundary basins focused on improving water management and cooperation between the riparian countries. Most of the projects have climate components, for example, climate change adaptation measures were integrated into the transboundary water management documents in such basins as the Amazon, the Chu-Talas, the Dniester, the Drin, and others. Such topics as agriculture, energy, ecosystems, and biodiversity were also included in the projects. Thus, GEF International Waters helps to integrate climate action with SDG 6 as well as 2, 7, 14, 15, and 17.	Global Environment Facility, n.d.

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