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LIST OF ACRONYMS

1992 Earth Summit (Rio 92)

Access and Benefit-Sharing (ABS)

Amazon Cooperation Treaty Organization (ACTO)

Amazon Regional Observatory (ARO)

Alliance of the Small Island States (AOSIS)

Artificial Intelligence (AI)

Association of Amazonian Universities (UNAMAZ)

Battery Energy Storage Systems (BESS)

Brazilian Development Bank (BNDES)

Brazilian National Action Plan to Combat Desertification and Mitigate the Effects of Drought (PAB)

Clean Development Mechanism (CDM)

Civil Society Organizations (CSOs)

Climate Technology Centre & Network (CTCN)

Collective Benefit, Authority to Control, Responsibility, and Ethics (CARE)

Committee on Science and Technology (CST)

Common But Differentiated Responsibilities and Respective Capabilities (CBDR-RC)

Conferences of the Parties (COPs)

Convention on Biological Diversity (CBD)

Facilitation Working Group (FWG)

Fifth Assessment Report (AR5)

Genetically Modified Organisms (GMOs)

Indigenous People and Local Communities (IPLC)

Intergovernmental Panel on Climate Change (IPCC)

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)

Joint Liaison Group (JLG)

Local Communities and Indigenous Peoples Platform (LCIPP)

Low-income Countries (LICs)

Multilateral Agreements on the Environment (AMUMAs)

National Biodiversity Strategies and Action Plans (NBSAPs)

National Commission on Agroecology and Organic Production (CNAPO)

National Council for Food Security and Nutrition (CONSEA)

National Council for Sustainable Rural Development (CONDRAF)

Nationally Determined Contributions (NDCs)

National Institute for the Semi-Arid (Insa)

Nature-based Solutions (NbS)

Science and Policy Interface (SPI)

Science, Technology and Innovation (STI)

Sixth Assessment Report (AR6)

Small Island Developing States (SIDS)



Subsidiary Body for Scientific and Technological Advice (SBSTA)

Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA)

Sustainable Development Goals (SDGs)

Technology Executive Committee (TEC)

Technology Facilitation Mechanism (TFM)

Technology Needs Assessment (TNA)

Third World Network (TWN)

Traditional Ecological Knowledge (TEK)

United Nations Convention to Combat Desertification (UNCCD)

United Nations Department of Economic and Social Affairs (UN DESA)

United Nations Framework Convention on Climate Change (UNFCCC)

EXECUTIVE SUMMARY

ver three decades have passed since the 1992 Earth Summit (Rio 92) and the success of multilateral environmental agreements still depends, more than ever, on the ability to leverage Science, Technology, and Innovation (STI) to address the interconnected crises of climate change, biodiversity loss, and land degradation. However, this will only be possible upon recognizing both the transformative potential of STI and the risks, inequalities, and tensions potentially resulting from the social, economic, and political processes related to these agendas. This policy brief analyzes how key multilateral agreements emerging out of the 1992 Earth Summit (Rio 92) address STI, focusing on the three major ecological conventions - The United Nations Framework Convention on Climate Change (UNFCCC); The Convention on Biological Diversity (CBD); and The United Nations Convention to Combat Desertification (UNCCD) -, as well as their respective follow-ups, including the Paris Agreement (2015) and the Kunming-Montreal Global Biodiversity Framework (2022). Discourse analysis of these documents points to three broad trends. First, there has been a certain degree of flexibilization of the understanding of the STI agenda reflected in major agreements, associated with an increase in the number of stakeholders involved in the negotiations. In particular, Global South nations, civil society, Indigenous Peoples and traditional and local communities have advocated for a less top-down approach, in other words, a less hierarchical view to STI in both climate and ecological negotiations. This trend, however, risks being undermined given the current state of the debate on the digital revolution, especially AI. Second, there has been growing acknowledgement that STI bears intricate and sometimes unforeseen consequences for climate and the environment, including implications that worsen existing socioeconomic inequalities. Third and finally, the discourse points to the importance that STI has in reinvigorating the "synergy agenda," in other words, efforts to recognize, explore, and address the multiple overlaps between the Rio 92 Conventions (in addition to other equally important frameworks, such as the 2030 Agenda for Sustainable Development). This synergy bears strong implications for the dual role of STI - which can magnify both the positive and negative aspects of climate and the environment. The Belém Declaration offers an example of regionalization - reflecting, to some degree, all three trends identified in the analysis, but also facing challenges that are specific to the region.





Based on this analysis, the policy brief offers recommendations to negotiators, civil society representatives, and other actors involved in the negotiations and discussions of the Rio 92 Conventions. In light of the challenges recognized, the brief provides twenty recommendations to be implemented at both the international and national levels. The recommendations are briefly listed below and discussed in depth at the final section of the document.

RECOMMENDATIONS - INTERNATIONAL LEVEL

Reinforcing synergies among the Rio Conventions

- 1 Establishing a regulatory framework for the integration and strengthening of Indigenous, traditional, and local knowledge including that of Afrodescendant populations and farming communities -, within the subsidiary and scientific bodies of the Rio Conventions.
- 2 Strengthening coordination and synergies among key science-policy bodies.
- Creating an inter-convention protocol for the governance of climate and environmental data.
- Establishing a mechanism for integrated, effective, and dignified social participation of Indigenous peoples, traditional peoples and communities, family farmers, and Afro-descendant populations in the three conventions.

Reinforcing synergies under the framework of the Convention on Climate Change

- Strengthening the Local Communities and Indigenous Peoples Platforms (LCIPP) under the UNFCCC, regarding and in cooperation with other Convention instruments and spaces, to ensure a more agile and effective response to demands.
- Establishing a Permanent Working Group on Climate Knowledge Systems, tasked with serving as an interface between the LCIPP and the UNFCCC's subsidiary bodies.

Rethinking technology transfer models and new innovation co-production models

- Reviewing the frameworks of instruments established under international conventions, such as the UNFCCC Technology Mechanism, to strengthen the endogenous capacities of scientific and technological development of Global South nations by reframing traditional hierarchical, or top-down, technology transfer models.
- Strengthening socio-territorial metrics for assessing the impact of STI policies in climate vulnerability contexts.
- Promoting intersectoral approaches that integrate environmental governance with broader social and economic imperatives, thereby avoiding isolated technological solutions.
- Accelerating and enhancing the implementation of the Joint Work Programme between the Climate Technology Centre and Network (CTCN) and the Technological Executive Committee (TEC) -, while ensuring greater space for new innovation-focused models of co-production and cooperation under the UNFCCC Technology Mechanism.
 - Addressing and mitigating financial barriers to enable a fairer distribution of green technologies across all developing nations and fostering innovation in the Global South.
- Strengthening South-South cooperation in STI for climate and the environment, focusing on developing technological, social and policy solutions tailored to the current ecological, cultural, and economic conditions of Global South countries.
- Increasing funding allocation for research collaboration between the Global North and the Global South on environmental and climate issues.
- Reinforcing regional cooperation efforts, such as those outlined in the Belém Declaration, to ensure locally appropriate solutions and to develop and implement a unified STI strategy aimed at strengthening socio-biodiversity value chains across the Pan-Amazon region.

RECOMMENDATIONS - BRAZILIAN NATIONAL LEVEL

- Fostering a regulatory framework for the integration of Scientific, Traditional, and Local Knowledge into the National STI System.
- Establishing a national policy for the governance of climate and territorial data based on social participation, recognition of citizen-generated data, socio-territorial impact indicators, and the principles of digital commons.
- Adding data sovereignty as a pillar of a just ecological and digital transition.
- Establishing Integrated Regional Centers of Innovation for Just Transitions.
- Promoting discussions on technology transfer by leveraging the National Action Plan to Combat Desertification and Mitigate the Effects of Drought (PAB).
- Promoting the establishment of a national mechanism for the convergence of the Rio Conventions to foster integrated approaches across the climate, biodiversity, and desertification agendas.
 - Key-words: science, technology, innovation, climate, environment, biodiversity, artificial intelligence

1. INTRODUCTION

iscussions about how to address the intersection between the ecological crisis - defined by increasingly intertwined dynamics of climate change, biodiversity loss, pollution and contamination, and unsustainable use of resources -, and Science, Technology and Innovation (STI) have been intensifying in multilateral spaces. Those debates have gained momentum not only in STI-dedicated forums, but also within the G20 and, more recently, as part of preparations for COP30, to be held in Belém, Brazil, in November 2025. However, these discussions are not new; neither do they exist within a vacuum. Quite the opposite, in fact: they result from over three decades of debates, negotiations and initiatives undertaken within the realms of the environment and climate change. Analyzing those debates is essential not only to contextualize emerging debates, such as those around All and other aspects of the digital revolution, but also to better grasp how that intersection has been interpreted over time by negotiators and civil society, in addition to determining the key actors that have been driving this agenda.

At the United Nations Conference on Environment and Development (known as the Earth Summit, Rio Summit, or Rio 92) held in 1992, STI was recognized as a pivotal cornerstone of global cooperation on ecological and sustainable development issues. Broadly put, the conference spurred three conventions – the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and the United Nations Convention to Combat Desertification (UNCCD). These have framed STI as an important component for addressing the mounting challenges of climate change, biodiversity loss, desertification and land degradation- as well as a key element in promoting sustainable development and ensuring human wellbeing and dignity.

Decades later, however, the promises linked to the STI agendas have yet to come through, even as the ecological crisis intensifies. If anything, concerns have multiplied over the climate and environmental footprints caused by new technologies like AI and cloud computing, as well as the risks that poorly governed STI instruments pose to society - including from the perspectives of climate and environmental justice. Meanwhile, and far from standing still, the role of STI has been discussed, negotiated, and reframed over time. As discussions gain traction, the STI agenda has become more central to- and complex within -, global environmental and climate negotiations.

This policy brief is centered on the following questions: How, and why, have understandings of STI changed over time in the Rio 92 agenda? What are the implications of these shifts for the implementation of the three main ecological conventions (UNFCCC, CBD, and UNCCD)? Which actors are involved in these processes and what paradigms do they hold in place to devise and implement STI policies? More specifically, this brief analyzes how key multilateral agreements emerging out of Rio 92 address STI, focusing on the three conventions and their respective follow-ups, including the Paris Agreement (2015) and the Kunming-Montreal Global Biodiversity Framework (2022). Consistent with the Rio 92 conference, which brought attention to the interconnectedness between the economic, social, and environmental aspects of sustainable development, the analysis also references the 2030 Agenda for Sustainable Development, as well as the Belém Declaration (2023) as a case of regionalization.

In addition to this introduction, this policy brief includes seven sections. The first provides a brief literature review focused on discussing and analyzing key definitions surrounding the ecological crisis, as well as insights into science, technology, and innovation. Next, major multilateral agreements and their respective mechanisms and follow-ups, such as Conference of the Parties (COP) processes, are described and analyzed. The three following sections examine major trends that cut through - and bridge the gap between -, both STI and climate agendas, ranging from an enhanced critical look on a topdown STI view and the growing acknowledgment of the duality of the role played by STI, to expanded debates on the conventions' synergy agendas and their implications on the matter. Next is a section dedicated to carrying out a brief assessment on Pan-Amazonian cooperation from the standpoint of the Belém Declaration. Finally, the last chapter compiles a set of policy recommendations for negotiators, civil society representatives, and other stakeholders involved in multilateral negotiations of the ecological crisis and STI agenda.

2. THE ECOLOGICAL CRISIS AND STI AGENDA: DEFINITIONS AND CONCEPTUAL FRAMEWORKS

The concept of ecological crisis refers to the current state of environmental unsustainability resulting from human-induced ecological damage, including the predatory use of natural resources and its resulting scarcity, in addition to pollution, and biodiversity loss. Together, these phenomena can lead to serious, long-lasting and potentially irreversible harm to ecosystems and human life. The idea of an ecological crisis acknowledges that climate change is not the only major crisis faced by humanity. Climate change, after all, is intricately linked to biodiversity loss, land degradation, desertification, and other environmental issues, as it exacerbates existing stresses on ecosystems and species¹. Furthermore, the unsustainable use of natural resources is deeply entwined not only with those crises, but also with the dominant modes of production and consumption that drive modern economies. This suggests that, rather than a conservationist approach, what is needed is a political economy perspective that integrates sustainable development, including appropriate STI-related aspects.

Discussing the ecological crisis implies the need to account for a number of observations, of which two stand out as particularly noteworthy. The first is that, although the dynamics are global in scale, their consequences are felt both locally and regionally. And second, those impacts are unevenly distributed, with the most negative effects disproportionately borne by those who are already highly vulnerable and exposed to challenges like climate change and biodiversity loss. As a result, the ecological crisis we face today is deeply connected to environmental and climate racism - in other words, to the fact that racialized groups and non-white people (particularly Black and Brown populations, Afro-descendants, people of Arab descent, Indigenous Peoples and traditional and local communities) are much more broadly impacted by the climate and environmental crisis².

^{1.} UNFCCC. What is the triple planetary crisis?, 2022, https://unfccc.int/news/what-is-the-triple-planetary-crisis.

^{2.} Peregum. Racismo Ambiental e Emergências Climáticas no Brasil, São Paulo, 2023, https://peregum.org.br/publicacao/racismo-ambiental-e-emergencias-climaticas-no-brasil/.

In this study, Science, Technology, and Innovation (STI) refers to the processes through which scientific knowledge and technological advancements are understood, developed, applied, and diffused to shape economies, societies, and governance systems. Science encompasses both the systematic pursuit of knowledge about the natural and social worlds and the institutional structures that shape how research is conducted, validated, and disseminated. Technology, in turn, refers not only to tools and artifacts but also to the systems, infrastructures, and policies that determine how technological development unfolds. Finally, innovation extends well beyond market-driven advancements to account for diverse forms of knowledge production, as well as social and institutional innovations that respond to collective needs and challenges.

Far from being set in stone, the meanings of science, technology, and innovation are interpreted differently over time and also across distinct cultures and political contexts³. Knowledge production, particularly scientific, is often envisioned as a neutral, objective and/or universally beneficiary force4. Nevertheless, this brief perceives STI as the result of a social construct profoundly intertwined by power dynamics, geopolitical conflicts and interests, and historical and economical contingencies that define who produces, validates, and disseminates knowledge, who controls technology, and who benefits from innovation. In the same way that technology cannot be viewed as a neutral instrument of progress - but rather as a system shaped by economic interests, governance frameworks, and historical inequalities -, innovation, too, is neither inherently positive nor transformative. Its direction and impacts, after all, ultimately depend on the interests and priorities that shape it. Recognizing these complexities is essential to understanding the evolving role of STI in global environmental governance and sustainable development.

^{3.} Edgar Zilsel (1941) argues that the belief that humanity has become increasingly intelligent over time—until the day that highly skilled researchers and scientists emerged and produced "science" as the final stage of intellectual ascent -, stems from the assumption that "our own civilization" represents the natural pinnacle of human evolution: "Were there many separate cultures in which 'science' developed and others in which it is 'lacking'—still in the making [...] Historical reality, unfortunately, is different, for 'fully developed science' appears only once, namely, in modern Western civilization" (Zilsel, 1941, p. 935). The intended framing of "science" here therefore relates to the historical process of modern Western civilization. This is one of the possible framings, given that "human thinking has developed in many and different ways - among which one is the scientific" (Zilsel, 1941, p. 936). In analyzing the scientific policy of modern Western civilization, however, this appears to be one of the possible- albeit limited-, framings, highlighting contradictions and conflicts in colonial contexts. Zilsel, E. The Sociological Roots of Science. Reprinting in Social Studies of Science, vol. 40, no. 6, 1941.

^{4.} Kilomba, G. *Memórias da plantação:* Episódios de racismo cotidiano, Cobogó, 2019.

Against this backdrop, the critical approach to STI adopted in this policy brief recognizes that its instruments are not just about technological progress but also about who sets the agenda, whose knowledge is valued, and how innovation can be mobilized in the service of social and ecological justice, rather than deepening existing disparities. A number of authors, including Cusicanqui⁵ and Escobar⁶, have been very vocal on the matter, challenging the dominant Western paradigms of Science, Technology, and Innovation (STI). Meanwhile, Shiva⁷ (1993) critically examines how scientific authority and technological progress are shaped by power dynamics. These analyses unveil the existence of other perspectives - more critical ones, for that matter -, and point to attempts in place to balance ecological justice, biodiversity protection, and equitable innovation.

In addition, the critical approach used in this policy brief also recognizes and acknowledges the role that networks of actors, under their multiple forms, play as producers of knowledge, technologies, and innovations - especially territorialized networks and movements that are also representative of so-called Indigenous Peoples and Local Communities (IPLC), traditional peoples and communities, and guardians of biodiversity⁸. Shifts in paradigms of science and technology-focused policies, as discussed by Velho⁹, as well in response to epistemicide, in dialogue with Carneiro¹⁰, have increasingly

- **5.** Cusicanqui, S. *Ch'ixinakax utxiwa*: On Decolonising Practices and Discourses, Wiley, Hoboken, NJ, 2020.
- **6.** Escobar, A. *Designs for the Pluriverse*: Radical Interdependence, Autonomy, and the Making of Worlds, Duke University Press, Durham, NC, 2018, https://doi.org/10.1215/9780822371816.
- **7.** Shiva, V. Monocultures of the Mind: Perspectives on Biodiversity and Biotechnology, 1993, https://doi.org/10.1177/0019556119930304.
- **8.** The terminology "Indigenous Peoples and Local Communities" (IPLC) is used under the UNFCCC. The terminology "Traditional Peoples and Communities" is introduced in the National Policy for the Sustainable Development of Traditional Peoples and Communities, established by Decree No. 6,040/2007, which encompasses 28 groups recognized by the Brazilian State. According to Brazilian legislation on access to genetic heritage, protection and access to associated traditional knowledge, and benefit-sharing (Law No. 13,123 of 2015 and Decree No. 8,772 of 2016), representatives of Indigenous Peoples, traditional peoples and communities, and family farmers holders of specific rights within this legal framework -, identify themselves as "guardians of biodiversity," particularly due to the crucial role they play in the preservation and promotion of knowledge and practices that favor the diversification of biological populations and ecosystems.
- **9.** Velho, L. Conceitos de Ciência e a Política Científica, Tecnológica e de Inovação. Sociologias, Porto Alegre, ano 13, nº 26, jan/abr. 2011, p. 128-153
- **10.** Carneiro, S. A construção do outro como não-ser como fundamento do ser. 2005. Tese (Doutorado) Universidade de São Paulo, São Paulo.

pushed the diversity and plurality of actors who produce knowledge well beyond the traditional roles of scientists affiliated with higher learning and research institutions or, still, to that of workers in medium to large-scale companies. For the sake of consistency, the term "Indigenous, traditional and local knowledge" will be used throughout this brief to encompass the multiple knowledge systems of these social groups. Likewise, the term "Indigenous Peoples and traditional and local communities" will be used to refer to all IPLCs, local peoples and communities, and guardians of biodiversity".

Accordingly, the Rio 92 Conventions - and the dynamics surrounding them -, also reveal tensions and conflicts regarding how STI is leveraged. They have encompassed, and continue to encompass, different perspectives and disputes over STI-related concepts and policies. It is therefore critical to conduct a more detailed analysis of Rio 92, considering not only climate and environmental governance resolutions, but also all related conflicts and actors involved. While multilateral mechanisms do not account for the only spaces that define how STI is produced, negotiated, adopted, or shared, they do play a significant role in shaping them by setting global norms, standards, and regulations¹². They are significant loci of narrative-building and negotiation that determine the parameters for the understandings of STI at the global level. These spaces influence funding priorities, facilitate international collaborations, and create frameworks for intellectual property rights and technology transfer, which, in turn, shape innovation pathways as well as access to emerging technologies. Additionally, multilateral spaces reflect geopolitical and geoeconomic factors- such as power struggles, competition between countries, and national security concerns -, that influence not only which aspects of STI are prioritized, but also who gains access to them, and how they are distributed within and across borders¹³.

^{11.} However, the limitations of the present study are highlighted in addressing the specificities of the 28 segments recognized by the Brazilian State within these categories, including Indigenous peoples, *quilombolas*, *babaçu* coconut breakers, *Caiçaras* and gypsy peoples, as well as the differences among farming communities.

^{12.} Juma, C. Transfer of Technology and Access to Scientific Knowledge and Applications, *Critical Issues in Human Rights and Development*, Elgar, Cheltenham, 2021, 108–129, https://doi.org/10.4337/9781781005972.00014.

^{13.} Patra, S. K. & Muchie, M. *Science, Technology and Innovation in BRICS Countries*, Routledge, London, 2020.

Against this backdrop, an examination of multilateral documents reveals the power dynamics, values, and assumptions that shape global agreements and policies¹⁴. Accordingly, the study of the language and structure of these studies sheds light on how STI issues are addressed, prioritized, or marginalized in international negotiations. As a result, this analysis examines the text, negotiations, and structures surrounding Rio 92, as well as the conventions that emerged from that conference and other documents devised since then within the framework of global climate and environmental governance.

^{14.} Grovogui, S. N. *Beyond Eurocentrism and Anarchy*: Memories of International Order and Institutions, Palgrave Macmillan, 2006, https://doi.org/10.1007/978-1-137-08396-8.

3. RIO 92, ITS CONVENTIONS, AND STI: BUILDING NEW MULTILATERAL INSTRUMENTS

The Earth Summit - or Rio 92 -, was held in the city of Rio de Janeiro, in Brazil, in June 1992. The event brought together world leaders, negotiators, scientists, and civil society representatives to address the growing ecological crises of the late 20th century. The conference took place at a time when concerns about climate change, biodiversity loss, and desertification were gaining international attention. Within this context, it built upon earlier efforts, such as the 1972 Stockholm Conference, and established a more comprehensive framework for sustainable development.

Rio 92 resulted in major agreements that shaped the multilateral environmental agenda in the decades to come, with lasting impact on STI. Among its most significant outcomes were the adoption of the three previously mentioned conventions, namely the UNFCCC, CBD, and UNCCD¹⁵. These legally binding agreements set the foundation for global action on climate change, biodiversity conservation, and land degradation. Additionally, the conference led to the creation of Agenda 21, a comprehensive action plan for sustainable development that embedded STI as a key enabler of environmental governance and policy implementation.

One specific trait of Rio 92 is of particular significance for STI, which is that the conference was instrumental in paving the way for allowing the UNFCCC to first recognize the historical responsibility of Global North countries for the climate crisis, while, at the same time, signaling the need for a collective response to address the situation. This came to fruition with the **adoption of the principle of Common But Differentiated Responsibilities** (CBDR), a concept that would later take on the term "respective capabilities," renaming the acronym CBDR-RC. The concept acknowledges that, while all countries share responsibility for addressing environmental problems, industrialized nations, as the main historical contributors to ecological degradation, bear a greater burden in financing and supporting sustainable development. **The principle of CBDR-RC has become one of the cornerstones for STI policies within the framework of the UNFCCC**. From that point forward, technology

^{15.} While it is often stated that the three conventions - UNFCCC, CBD, and UNCCD -, are the Rio Conventions, the UNCCD was only officially established in 1994. However, the foundations of the convention were laid in 1992, which is why it is considered a sister convention to the other two environmental agreements.

transfer - from the Global North to the Global South -, has shaped many of the policies negotiated in multilateral spaces, based precisely on the premise that industrialized nations bear responsibility (and, as a result, the duty of providing support) for the technological development of developing nations. However, as discussed throughout this brief, the implementation of this paradigm has not been without its share of challenges and is yet to come through as originally envisioned.

On the one hand, Rio 92 took place in a geopolitical landscape defined by persistent differences between developed and developing nations. Even before the conference, Global South countries had already been vindicating recognition of their right to development and to financial and technological support from industrialized nations, with the aim of introducing sustainability measures and validating their own environmental knowledge¹⁶. At Rio 92, the existence of these structural disparities was further evidenced.

On the other hand, the geopolitical landscape was heavily influenced by the post-Cold War optimism of the early 1990s, when multilateral cooperation was widely seen as an increasingly viable means of addressing global challenges¹⁷. The collapse of the Soviet Union had reshaped international politics, reducing ideological polarization and fostering the idea that global governance mechanisms, including those for environmental protection, could be strengthened. At the same time, economic globalization and the rise of neoliberal policies meant that both market-based solutions and voluntary commitments were increasingly favored over binding international regulations¹⁸. The period was therefore also defined by an uptick in optimism over new technologies and innovations in communications, such as personal computing and the Internet. At the time, there was an expectation that these innovations would play a key role in helping overcome major global challenges, among them the ecological crisis. These expectations, however, have been continuously thwarted.

Far from an isolated event, Rio 92 propelled a series of agendas on climate, environment, and sustainable development that continue to shape

^{16.} Vadrot, A. Multilateralism as a 'Site' of Struggle over Environmental Knowledge: The North-South Divide, *Critical Policy Studies*, 2020, 14 (2), 233–245, https://doi.org/10.1080/19460171.2020.1768131.

^{17.} Sen, A. Development as Freedom, New York: Alfred Knopf, 1999.

^{18.} Nayyar, D. International Migration and Economic Development, *The Washington Consensus Reconsidered:* Towards a New Global Governance, 2008, https://doi.org/10.1093/acprof:oso/9780199534081.001.0001.

international and national policy today - and are closely intertwined with the global STI agenda. The summit laid the groundwork for the Kyoto Protocol (1997) and later the Paris Agreement (2015) under the UNFCCC, both of which have defined global climate action. Under the UNFCCC, Article 4.1.c sets out that countries, in consideration of the principle of CBDR, should promote cooperation in the development, use, and dissemination of technology for the Global South. The article further serves as a cornerstone for Article 10 of the Paris Agreement that was signed 23 years later, and which restates the role that STI has in addressing the climate crisis by means of the Climate Technology Centre & Network (CTCN), which will be discussed in more detail later on.

Similarly, the principles and commitments established under the Convention on Biological Diversity (CBD) have evolved through successive meetings of the Conference of the Parties (COP), leading to milestones like the Aichi Biodiversity Targets (2010) and the Kunming-Montreal Global Biodiversity Framework (2022). The concept of sustainable development, which was a central theme at Rio 92, was further institutionalized through the Millennium Development Goals (MDGs), launched in September 2000.

The Rio+20 Summit, held in 2012, marked the 20th anniversary of the original Rio 92 Conference and served to reassess global progress on sustainable development while addressing new challenges such as the green economy, corporate sustainability, and sustainable consumption and production. Among other outcomes, Rio+20 laid the groundwork for the 2030 Agenda for the Sustainable Development Goals (SDGs), reinforcing the need for a more integrated approach to economic, social, and environmental sustainability in global governance. Moreover, it acknowledged the potential of STI to enhance productivity, induce economic transformation, increase growth rates, create decent jobs, and reduce fossil fuel consumption.

However, despite all the progress made, there is a lingering feeling, even after decades, that a promise was not kept. This policy brief provides and discusses a diagnosis whereby the elements related to STI across all three conventions – particularly the UNFCCC –, have failed to fulfill the role that was originally assigned to them back in 1992. The mechanisms and devices established so far have proven insufficient and operate under a rationale that lacks distributive fairness. Overall, the mobilization of STI agendas and systems stems from a broad conception which, despite having been devised through the active participation of the Global South, has failed to deliver on its intended role. The dominant top-down paradigm has limitations in addressing structural issues associated with inequality – both economic and legal, such as intellectual property and patents

rights –, and, upon relying on the principle of technology transfer, tends to downplay other potential STI development models, such as scientific and technological co-production. At the same time, technology transfer from the Global North to the Global South is not entirely guaranteed.

In reality, the paradigm fails to prioritize addressing the main challenges related to inequality and falls short in ensuring that the principle of CBDR-RC effectively steers STI policies. In the realm of scientific production, significant gaps persist, mirroring the limitations in fully incorporating the knowledge and sciences of traditional and local peoples and communities. In the specific case of the UNFCCC, there is a clear governance issue in STI-related mechanisms – such as the Technology Mechanism, Local Communities and Indigenous Peoples Platform, the Subsidiary Body for Scientific and Technological Advice (SBSTA) and, to an extent, the Intergovernmental Panel on Climate Change (IPCC) –, which run in an exceedingly fragmented manner and with limited dialogue and cooperation among themselves to show for, consequently undermining their workings and efficacy.

While summits like Rio 92 and Rio+20, as well as major environmental conventions and their follow-ups set important foundations for collective action, their implementation has often been constrained by geopolitical, political, and economic factors- including those that shape how STI is understood, produced, shared, and accessed. These subjects are described in greater detail throughout this policy brief.

The following sections present an analysis on how STI has evolved in the realms of global climate and environmental governance. This is done through an examination of the documents and resolutions issued from multilateral spaces, the actors involved and, more broadly, the political and socioeconomic power dynamics surrounding STI-related issues. The analysis is enriched with secondary sources, especially policy papers and academic articles that provide context into the political, social, and economic factors influencing multilateral decision-making. Furthermore, a case study in regionalization, focused on the Amazon region and the 2023 Belém Declaration, offers insights into how multilateral commitments are interpreted and implemented at the regional level.

The analysis shows that there are three current major trends in the pathway of STI agendas within global climate and environmental governance. First, criticism has been on the rise and different options have been devised to challenge the dominant top-down paradigm - a shift that has been followed - and driven -, by an increasing number of actors involved in negotiations. In this context, the role of developing countries, civil society and Indigenous Peoples and local and traditional communities is of particular note, since they have been fostering a less hierarchical approach - that is, one less centered on top-down decisionmaking -, in STI-focused discussions within climate and ecological negotiation spaces. However, this approach is at risk of backtracking given the current stage of the debate on the digital revolution, particularly Al. Second, there has been growing recognition that STI entails challenging - and, at times, unpredictable -, impacts on climate and the environment, including implications potentially capable of exacerbating already existing socioeconomic inequalities. Third, and last, there is a clear resumption of the so-called "synergy agenda," aimed at recognizing, integrating, and addressing the multiple connections between the conventions signed at Rio 92 (as well as other equally significant frameworks, such as the 2030 Agenda for Sustainable Development).

TIMELINE

1972

Stockholm Conference

The United Nations Conference on the Human Environment, which took place in Stockholm, Sweden, was the first United Nations meeting to specifically address environmental issues.

The Intergovernmental Panel on Climate Change was established in 1988 and is currently the main scientific body providing information to the UNFCCC.

1988

Establishment of the IPCC

1992

Rio 92

Officially named the United Nations Conference on Environment and Development, though it was also known as the Earth Summit or Rio 92, this meeting produced the three UN framework conventions: UNFCCC, CBD, and UNCCD.

Agenda 21

Agenda 21 was a document signed by 179 countries at Rio 92.

1994
Official
establishment
of the UNCCD

While it was envisioned still at Rio 92, the UNCCD was officially established only in 1994. 1995

Official establishment of the UNFCCC SBSTA

Subsidiary Body for Scientific and Technological Advice (SBSTA).



An international agreement signed in 1997 by 84 countries with the goal of reducing greenhouse gas emissions. The agreement provides for instruments such as the Clean Development Mechanism (CDM), which, among other criteria, sets out objectives related to the transfer of renewable energy technologies to Global South countries.

1997

Kyoto Protocol

2000

Millennium Development Goals (MDGs) In 2000, in New York, USA, 189 countries signed off on the Millennium Declaration, which lays out eight goals to be met by 2015.

Cartagena Protocol on Biosafety Environmental treaty stemming from the CBD aimed at ensuring adequate protection of the so-called Living Modified Organisms (LMOs).

The Joint Liaison Group (JLG) was instituted by the secretariats of the CBD, UNFCCC, and UNCCD to integrate approaches that contribute simultaneously to the three agendas.

2001

Establishment of the JLG

2010

Aichi Biodiversity Targets Set of targets adopted during the 10th Conference of the Parties to the CBD (COP10), held in the Japanese Prefecture of Aichi, with the aim of implementing tangible measures to halt global biodiversity loss up to 2020.

2010

Cancun Agreements

Agreements made by the UNFCCC in 2010, with the goal of updating climate commitments following the Kyoto Protocol.

The United Nations Conference on Sustainable Development took place 20 years after Rio 92 and gave new momentum to the multilateral environmental debate.

The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) was instituted under the framework of the CBD.

2012

Rio+20 Summit

Establishment of the IPBES under the CBD

2013

Establishment of the CST and SPI under the UNCCD

The Committee on Science and Technology (CST) and the Science-Policy Interface (SPI) were established during the desertification-focused COP11 held in Windhoek, Namibia.

The Paris Agreement is a legally binding international treaty on climate change endorsed by 195 countries during COP21 to limit global warming well below 2°C, and preferably below 1.5°C.

The agenda was approved by 193 UN Member States as a follow-up to the Millennium Development Goals.

2015

Paris Agreement

2030 Agenda



Establishment of the UNFCCC Technology Mechanism The Technology Mechanism, which encompasses both the Climate Technology Centre and Network (CTCN) and the Technological Executive Committee (TEC), was created under Article 10 of the Paris Agreement.

Establishment of the Indigenous Peoples and Local Communities (IPLC) Platform

The Platform was instituted under the UNFCCC as a means to bridge the gap between Indigenous Peoples and local communities - and their knowledge -, and the Convention spaces.

Conference that allowed for the implementation of the TEC and CTCN.

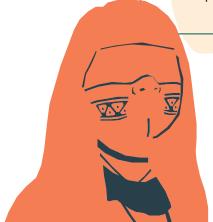
2018

Katowice Climate
Change COP24

2022

Sharm-el-Sheikh Climate Change COP27 During COP27 in 2022, the Joint Work Programme of the UNFCCC Technology Mechanism was officially launched.

Kunming-Montreal Global Biodiversity Framework Ratified at CBD COP15, Target 22 of the Framework underscores the importance of transformative and transdisciplinary education, together with the acknowledgment of Indigenous and local knowledge, while emphasizing the role of STI in implementing sustainable solutions for biodiversity.



Document signed by the eight Amazonian countries comprising the Amazon Cooperation Treaty Organization (ACTO) and featuring multiple STI-related commitments.

The Dubai-held climate change conference yielded the COP28 Joint Declaration on Climate, Nature, and People, which points to the need to deploy integrated efforts to address climate change and biodiversity loss.

Program created during COP28 as an outcome of the first Global Stocktake, aimed at introducing priority technologies to countries in response to challenges recognized by the Technology Mechanism.

2023

Belém Declaration

Dubai COP28 Declaration

Technology Implementation Programme

2024

Cali Biodiversity COP16

Biodiversity conference held in Cali, Colombia, which resulted, among other outcomes, in the creation of a permanent subsidiary body dedicated to the rights of Indigenous Peoples and traditional and local communities, under Article 8(j) of the Convention.



4. TREND NO.1: CONTESTING TOP-DOWN VIEWS OF STI

The first trend to be discussed in this policy brief is the increase in different viewpoints and criticism of the dominant trend in STI policies within global climate and environmental governance. This growth has stemmed from the increased participation and engagement of a wide range of actors, including state actors, particularly from the Global South, and non-state-actors, in multilateral negotiation spaces - which, in turn, has fostered more critical thinking as well as different options of proposals to the paradigm that has shaped STI policies in global environmental governance since 1992. However, certain developments, such as the unregulated expansion of artificial intelligence, have undermined the consolidation of this growing criticism.

Despite the broad participation of civil society in the Rio 92 conference - one of the priorities for the Brazilian government as convenor of the meeting -, the negotiations remained largely state-driven, and within those discussions, STI was primarily framed as a means of implementation¹⁹ for climate actions, particularly through technology transfer from the Global North to the Global South. This approach, embedded in both the UNFCCC (Article 4.5) and the CBD (Article 16), assumed that the diffusion of technologies spearheaded by industrialized nations would automatically benefit the developing world. As a result, the focus of the negotiations shifted to mechanisms such as financial support, capacity-building, and technology-sharing frameworks, without, however, addressing structural inequalities related to intellectual property rights (IPR), local capacities to absorb technologies, or, still, the definition of priorities. In reality, what took hold was an approach that failed to address major issues related to STI asymmetries.

In this context, a top-down - that is, vertical -, paradigm became entrenched, under which the transfer of technology from the North to Global South is expected to be the main means of implementing climate and environmental policies in STI. In reality, however, this has proven dysfunctional for several reasons. In effect, developed nations took on - or, better put, were expected to take on -, the role of technology "providers," whereas Global South countries were relegated to the position of recipients. This

^{19.} Means of implementation are defined as the instruments and resources required for countries - especially developing ones -, to fulfill their climate goals. These means primarily include the following: climate finance, technology transfer, and capacity-building.

reasoning is flawed not only because it presumes that STI solutions reside exclusively in industrialized nations and therefore overlook the knowledge, technologies, and innovation networks of the Global South as well as their own perspectives, but also because, by privileging this approach, it undermines the development of policies aimed at fostering endogenous STI capacity in developing nations.

Furthermore, this is a model in which decisions about what kind of science to produce and which technologies should be funded are made in a top-down, hierarchical manner. As previously discussed, these decision-making processes associated with scientific and technological production are often seen as neutral and objective and, as a result, are not frequently contested. Recognizing that STI priorities and models have been shaped by countries in the Global North, which have historically held broad economic power and political influence, makes it possible to distinguish the predominance of this top-down paradigm in global climate and environmental governance - and additionally opens space for increasing criticism against it, which has in fact been happening in recent years.

At first, criticism and concern over the top-down model fell largely on the inefficacy of instruments such as the **Clean Development Mechanism (CDM) under the Kyoto Protocol**, which proved insufficient in ensuring equitable access to low-carbon technologies. Later on, the **Paris Agreement (Article 10)** introduced a more dynamic **Technology Framework** aimed at fostering endogenous innovation in Global South countries. However, as discussed later on, this mechanism has also faced constraints in ensuring appropriate policies, particularly regarding funding, patent restrictions, and the role of non-state actors in shaping STI governance.

The top-down model also pervades Agenda 21 (1992)²⁰, which emphasized the "need for favorable access to and transfer of environmentally sound technologies.²¹" However, it often failed to account for the specific needs, capacities, and cultural contexts of recipient countries. More broadly, there was a lack of political will to implement those transfers. The 2012 UN Department of Economic and Social Affairs (UN DESA)²² review found

^{20.} United Nations. Agenda 21, United Nations Conference on Environment & Development, UN, Rio de Janeiro, 1992, https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf.

^{21.} United Nations, 1992, Chapter 34.

^{22.} UN DESA. Sustainable Development in the 21st Century (SD21): Review of Implementation of Agenda 21 and the Rio Principles. Synthesis, UN DESA, jan. 2012, https://sf.stakeholderforum.org/index.php/undesa-synthesis-review-of-agenda-21-and-the-rio-principles/.

that "funding arrangements and transfers of technology from developed to developing nations around the Agenda 21 outcomes have not been delivered as promised.²³"

Over time, as the number of stakeholders participating in international negotiations stemming from the Rio 92 agendas increased, the top-down paradigm began facing criticism. This expanded gamut of actors started involving both state and non-state actors. Among states, in the UNFCCC negotiations, Low Income Countries (LICs) increasingly emphasized the need for technology transfer and capacity-building that is tailored to local contexts²⁴. A noteworthy example is Bangladesh, which championed innovations in both flood-resistant agriculture and community-based early warning systems. Ethiopia, in turn, has sought to promote Climate-Resilient Green Economy (CRGE) strategies that integrate renewable energy and reforestation technologies²⁵.

Another developing country grouping that has become more influential in these negotiations is that of Small Island Developing States (SIDS), officially recognized as a distinct category of countries at the Rio 92 summit. As countries highly vulnerable to climate change and biodiversity loss-and having contributed very little to the climate crisis -, SIDS have been instrumental in ensuring that the UNFCCC recognizes the disproportionate risks they face (Article 4.8). In negotiations, they emphasize the need for technology transfer, capacity-building, and adaptation strategies rooted in scientific advancements. Their advocacy also contributed to the recognition of Traditional Ecological Knowledge (TEK) alongside "modern" STI approaches, highlighting the importance of more inclusive innovation systems. During the negotiations of the Paris Agreement, SIDS played a key role in securing the 1.5°C temperature goal, underscoring the need for technological innovation and climate science to support adaptation and mitigation²⁶.

More recently, the establishment of the Alliance of Small Island States (AOSIS) has allowed them to negotiate as a bloc, strengthening their position in climate negotiations, biodiversity discussions, and ocean governance-

^{23.} UN DESA, 2012.

^{24.} Huq, S. Enhancing the Role of the Least Developed Countries and Small Island Developing States in Addressing Loss and Damage, 2016.

^{25.} Tombe, T. B. Climate Change Education for Climate Resilient Green Economy (CRGE) of Ethiopia, *International Journal of African and Asian Studies*, 2016, 20, 89-105, https://www.researchgate.net/publication/338356385.

^{26.} UNFCCC. The Paris Agreement, Article 2.1, 2015, https://unfccc.int/sites/default/files/resource/parisagreement_publication.pdf.

all of which bear significant STI dimensions. However, this has also led to cleavages among Global South countries. Differing vulnerabilities and priorities between SIDS, LDCs, and larger developing nations have led to internal tensions within the Group of 77 (G77)²⁷, sometimes weakening its collective bargaining power in multilateral environmental negotiations²⁸, including over issues related to STI.

4.1. SUBSIDIARY BODIES AND SCIENCE-POLICY INTERFACE MECHANISMS IN THE RIO 92 CONVENTIONS

Since Rio 92, a number of bodies were established and tasked with providing technical and scientific guidance to the conventions, with subsidiary bodies being the key institutions for this purpose. The CBD Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the UNFCCC and the Committee on Science and Technology of the United Nations Convention to Combat Desertification (UNCCD) have been – and continue to be –, in charge of providing scientific evidence to inform negotiations.

In this regard, an example of good practice is particularly worthy of notice. During the 16th Conference of the Parties (COP 16) to the Convention on Biological Diversity (CBD), held in Cali, in Colombia, in 2024, a permanent subsidiary body was established, under Article 8(j) of the Convention, to tackle the rights of Indigenous Peoples and traditional and local communities. This article addresses the knowledge, practices, and innovations of Indigenous Peoples and traditional and local communities regarding biodiversity. This new body will therefore be responsible for handling the contributions provided by these Peoples and communities to issues such as biodiversity conservation, sustainable use of biological resources, and fair and equitable sharing of benefits. The Article 8(j) Work Programme, in effect until 2030, already sets out several various duties for this body, including the creation and strengthening of legal and policy frameworks to ensure the full and effective participation of Indigenous Peoples and traditional and local communities in Conventionrelated processes, in addition to devising an action plan on traditional knowledge associated with genetic resources. This will include measures aimed at ensuring the fair and equitable sharing of benefits and the effective implementation of both the Convention and the Nagoya Protocol

^{27.} The Group of 77 is the largest intergovernmental organization of developing countries within the United Nations and serves as a platform for strengthening their collective negotiating capacity on key international economic issues within the UN system.

^{28.} Gupta, A. Climate Governance and the Politics of South-South Solidarity, 2014.

on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization.

In addition, other bodies dedicated to promoting the interface between science and policy have been progressively incorporated into the conventions' frameworks. Under the UNCCD, the Science-Policy Interface (SPI) has fulfilled this role, while its counterpart within the biodiversity agenda is the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The IPCC, in particular, warrants a more in-depth discussion.

The IPPC has played a leading role in the climate agenda by providing top-level scientific information to the UNFCCC, including the latest processes concerning the first Global Stocktake, the general overview of the Paris Agreement. The panel has thus become an authoritative body on climate science, underpinned by "policy neutrality"- the idea that such science-policy interface bodies can shape policy options without setting forth specific guidelines for them. Analysts have noted, however, that the IPCC ultimately engages in inherently ideological "boundary work" as a result of seeking to maintain distinctions between the scientific and political realms.

Jasanoff²⁹, for instance, finds this work to be a means to gain control over key issues and thus to either maintain or defend epistemic authority. Beck and Mahony³⁰, in turn, note that, far from static, this work is highly dynamic, especially given the resurgence of climate skepticism and denial in the post-Paris Agreement climate regime, consequently prompting calls for the IPCC to focus its efforts on proving global warming and contributing more directly to the implementation and monitoring of policy actions. There has also been growing and regular criticism regarding the persistent disparity between the numbers of Global North and Global South representatives comprising the IPCC, as well as its limited openness to other types of scientific and knowledge production. Upon examining Working Group III in the wording of the Fifth Assessment Report (AR5), Corbera et al³¹, for example, note that inequalities in authorship between North and South persist, with a predominance of U.S. and United Kingdom authors and a co-authorship pattern largely concentrated in the Global North.

^{29.} Jasanoff, S. *The Fifth Branch*: Science Advisers as Policymakers, Harvard University Press, Cambridge, MA, 1990.

^{30.} Beck, S.; Mahony, M. The IPCC and the new map of science and politics, Wily Interdisciplinary Reviews, 9 (6), https://doi.org/10.1002/wcc.547.

^{31.} Corbera, E. et al. Patterns of authorship in the IPCC Working Group III report, Nature Climate Change, Advanced Online Publication, 6, 94-99, 2015, https://pismin.com/10.1038/nclimate2782.

According to McSweeney³², the geographic and national distribution of authors of the Sixth Assessment Report (AR6), which began in 2018 for the purpose of the report's release in 2023, was also highly uneven. Among the 721 authors, there was an overrepresentation of scientists from the Global North- particularly from the United States (74 authors) and Western Europe (with the United Kingdom and Germany accounting for 45 scientists each). Of the five countries with the most scientists represented, China only ranks fifth and was the only country from outside the Global North - despite having the second largest population in the world. There is also a noticeable underrepresentation of scientists from Africa and Latin America. Furthermore, only between 4% and 7% of authors came from least developed countries, which rank among the nations that are most impacted by climate change. McSweeney's mapping further evidenced an overrepresentation of male authors, accounting for 67% of all authors.

In assessing the participation and inclusion of knowledge from Indigenous Peoples and traditional and local communities, Ford et al. (2016)³³ look at the AR5 Working Group and broadly conclude that the scope of inclusion of Indigenous knowledge in the production of the Assessment Reports is limited and narrow. In their understanding, there is little critical engagement with Indigenous and traditional knowledge systems and both historical and contextual specificities are often overlooked. In the same vein, Bavel et al.³⁴ also state that Indigenous Peoples and their knowledge systems remain largely excluded and marginalized from IPCC assessment reports. According to the authors, despite recent progress made in past years, the IPCC's internal processes still lack well-established procedures, regulatory frameworks, and guidelines that allow for ethical engagement with Indigenous knowledge systems, and, as a result, the panel's current practices end up restricting the full inclusion of Indigenous knowledge. Finally, it is worth noting that the IPCC and other bodies working at the interface of science and policy have also been questioned on the grounds that their reliance on consensus-building among member states can lead to compromises that may potentially dilute scientific findings or, still, that

^{32.} McSweeney, R. Analysis: The gender nationality and institution of IPCC AR6 scientists. Carbon Brief: clear on climate, 2018, https://www.carbonbrief.org/analysis-gender-nationality-institution-ipcc-ar6-authors/.

^{33.} Ford, J. et al, Including indigenous knowledge and experience in IPCC assessment reports, Nature Climate Change, Perspectives, 6, 349-353, 2016, https://www.nature.com/articles/nclimate2954.

^{34.} Jasanoff, S. *The Fifth Branch*: Science Advisers as Policymakers, Harvard University Press, Cambridge, MA, 1990.

they are influenced by political agendas or heavily defined by Eurocentric views, resulting in biased conclusions³⁵.

4.2. CIVIL SOCIETY PARTICIPATION IN RIO 92 AND THE STI AGENDAS

The role of civil society in the Rio 92 conventions has evolved over time, reflecting a growing recognition of its importance in shaping global environmental and climate policies. At the Rio 92 Summit, it played a supportive yet somewhat peripheral role, primarily serving as a voice for environmental and social concerns, without direct influence on the negotiation process. However, as time went by, civil society's involvement became more central, with increased participation in negotiation processes, including the UNFCCC, CBD, and 2030 Agenda for Sustainable Development.

When the Cartagena Protocol on Biosafety (under the CBD) was negotiated in the late 1990s and adopted in 2000, for instance, many Civil Society Organizations (CSOs), especially those representing small-scale farmers, Indigenous Peoples and traditional and local communities, in addition to environmental NGOs, pushed back against the pro-technology framing of biotechnology promoted by corporations and a number of state actors. Groups like ETC Group, Third World Network, and La Via Campesina criticized how risk assessments were narrowly defined using scientific/ technical criteria, while failing to account for traditional knowledge and socio-cultural impacts³⁶. These groups demanded broader, precautionary approaches that recognized the risks that genetically modified organisms (GMOs) pose to local ecosystems and livelihoods. It is worth noting that grassroots organizations and social movements engaged in the food sovereignty agenda have historically showcased a strong capacity for organization and engagement in international governance spaces - and, to this end, they can, and should -, serve as examples of good practices for climate and environmental agendas. The establishment of a mechanism to allow civil society participation in the United Nations Committee on World Food Security, in 2010, as well as the adoption of the Declaration on the Rights of Peasants and Other People Working in Rural Areas, in 2018, are

^{35.} Beck, S.; Mahony, M. The IPCC and the new map of science and politics, Wily Interdisciplinary Reviews, 9 (6), https://doi.org/10.1002/wcc.547.

^{36.} Vía Campesina. Protocolo de Bioseguridad y Convenio sobre la Biodiversidad: No a la Privatização de la Biodiversidad. *Posición de la Vía Campesina*, 13 mar. 2008. https://viacampesina.org/es/protocolo-de-bioseguridad-y-convenio-sobre-la-biodiversidad-no-a-la-privatizacie-la-biodiversid/.

both examples of wins for small-scale farmer, agricultural ecology, and family farming movements.

These processes showcase the pursuit of a more inclusive approach to how STI has been addressed within environmental governance spaces, in which social, cultural, and ethical aspects are prioritized alongside technological advancement. Furthermore, CSOs have advocated for STI solutions that are not only scientifically sound but also equitable and context-specific, thereby ensuring that marginalized communities are included in the design and deployment of technologies. This influence has led to a broader acknowledgment that technological innovation must be aligned with the principles of fairness, accessibility, and access to resources, thus ensuring that its benefits are shared equitably across both the Global North and South.

Among non-state actors, Indigenous constituencies and local and traditional communities have played a crucial role over the past fifteen years in reshaping the understanding of STI within the Rio 92 agendas. Within the Convention on Biological Diversity (CBD), segments and groups of Indigenous Peoples and Communities have advocated for the recognition of Traditional Ecological Knowledge (TEK) as a legitimate and valuable form of science, knowledge, and innovation, challenging the dominance of Western scientific paradigms. This advocacy, however, has not been heterogeneous and is differently framed depending on institutional contexts, political negotiations, and cultural understandings which can even be validated with the Indigenous constituents themselves. These different streams of thought have led to concrete impacts on the conventions and negotiations. For instance, they successfully helped to include the provisions for Access and Benefit-Sharing (ABS) and the protection of Indigenous rights in the Nagoya Protocol (Articles 5-6) and the Kunming-Montreal Global Biodiversity Framework (Target 22) and, more recently, the establishment of the new subsidiary body in support of article 8(j), as previously mentioned.

The UNFCCC, in turn, has only recently created dedicated spaces to these groups, such as the Local Communities and Indigenous Peoples Platform (LCIPP), established in 2015. Among the LCIIPP's objectives, the three main ones include strengthening the exchange of knowledge and practices, expanding the inclusion of Indigenous Peoples and traditional and local communities in global governance spaces, and encouraging the participation of the groups in climate action. To support these efforts, the Facilitator Working Group, constituted by government representatives and Indigenous Peoples and traditional and local communities, was established

and tasked with supervising and facilitating the implementation of the platform's activities. Since its inception, the LCIPP has undertaken important measures, such as regional meetings among communities from across the globe, international gatherings, and knowledge-sharing spaces, including on sustainable technologies and climate policies. At COP29, held in 2024 in Baku, in Azerbaijan, its work plan, designated the Baku Workplan of the Local Communities and Indigenous Peoples Platform, was approved. It set forth six core Platform-focused processes for the coming years, including meetings with knowledge holders, an annual gathering based on the Seventh Generation Principle³⁷, cooperation with other UNFCCC bodies and work flows and, finally, enhanced engagement with the Parties³⁸.

The knowledge component of the LCIPP holds particular importance for the STI agenda. In 2024, core tasks were defined under this pillar, namely annual meetings with knowledge holders to share experiences and climate action practices; an annual dialogue session with Indigenous Peoples and traditional and local communities focused on integrating knowledge systems and values to strengthen climate policies; informal sessions aimed at enhancing engagement with platform collaborators; and the drafting of a report documenting these processes. Ongoing initiatives include regional engagement meetings and the development of unified Indigenous curricula and content, in addition to spaces for gatherings and exchange of experiences³⁹.

However, despite the progress made, the implementation of LCIPP initiatives has faced its own set of challenges. These include a lack of adequate funding and hurdles that hinder the full participation of Indigenous representatives, especially due to language barriers and the demanding pace of spaces such as Subsidiary Body meetings in Bonn as well as COPs⁴⁰ themselves. Furthermore, the inclusion of representatives of traditional and local communities in the FWG - in addition to Indigenous constituencies

^{37.} O princípio da sétima geração é baseado na filosofia Haudenosaunee, do nordeste da América do Norte, e diz que as decisões do presente devem ser tomadas pensando em seus impactos para as sete gerações futuras.

^{38.} UNFCCC. Draft Workplan of the Local Communities and Indigenous Peoples Platform for 2025-2027. FCCC/SBSTA/2024/1, https://lcipp.unfccc.int/sites/default/files/2024-12/ Baku Workplan of the Local Communities and Indigenous Peoples Platform.pdf.

^{39.} UNFCCC. Decision/CP.29. Local Communities and Indigenous Peoples Platform, https://unfccc.int/sites/default/files/resource/COP%2029_AUV_COP_Agenda_Item_3a_LCIPP.

^{40.} Fanzeres, A. Brasil amplia contribuições à Plataforma de Comunidades Locais e Povos Indígenas, Operação Amazônia Nativa, 2024, https://amazonianativa.org.br/2024/06/04/clima-comunidades-locais/.

-, has proven to be a sensitive matter⁴¹. These are spaces where country engagement remains relatively low, particularly when compared to other Convention mechanisms. Moreover, certain conceptual tensions have arisen in these spaces, such as differing views on whether traditional knowledge is primarily spiritual, practical, or simply instrumental, and on how Indigenous Peoples push back against tokenistic inclusion or the co-optation of their knowledge⁴².

Important advances can be observed within this setting. Still, certain issues pose emerging risks to an STI agenda based on local participation. This applies specifically to the current state of debate about the digital revolution, especially the rapid development of AI. The digital revolution, after all, is largely driven by Global North corporations that dominate the development and deployment of advanced technologies such as AI, blockchain, and big data analytics⁴³. While such technologies (AI, blockchain, and big data analytics) hold potential for proposing diverse alternatives and solutions for climate and environmental challenges, their governance and application remain mostly shaped by corporate interests and technocratic elites, rather than by the needs and priorities of marginalized communities⁴⁴.

Moreover, the rise of AI and the way the debate has been taking place has reignited debates about the ethics of innovation and the potential for technological determinism. The push for geoengineering solutions, such as solar radiation management, and the promotion of electric vehicles (EVs) as a silver bullet for climate mitigation, reflect the persistence of technocratic and vertical models that prioritize financial gains and uncollaborative technological fixes over systemic change. These strategies, bolstered by "technophoric narratives," tend to offer simplistic and often politically nonviable paths. As a result, they often carry significant risks, particularly for vulnerable communities, and may divert attention and resources away from more inclusive, affordable, and equitable approaches to sustainable development and social justice.

^{41.} To learn more on the subject, see the letter addressed to FWG members: FORMAD. Letter of Support to Local Communities, 2024, https://formad.org.br/wp-content/uploads/2024/05/Carta-de-apoio-a-Comunidades-Locais-LCIPP-pt_29_05.pdf.

^{42.} McGregor, D. Coming Full Circle: Indigenous Knowledge, Environment, and Our Future, *American Indian Quarterly*, 2004, 28 (3-4), 385-410, https://eric.ed.gov/?id=EJ683398.

^{43.} Nayak, B. S. & Walton, N. Political Economy of Artificial Intelligence: Critical Reflections on Big Data Market, Economic Development and Data Society, *Springer*, 2024, https://doi.org/10.1007/978-3-031-62308-0.

^{44.} Regattieri, L. IA e Mudanças Climáticas: O Sul Global diante da nova geopolítica da inovação, 2025, em vias de publicação.

Since Rio 92, a top-down approach centered on the transfer of technology from Global North to South has gained traction, centered on barely functional financing and capacity-building mechanisms but failing to address structural inequalities. In recent years, however, there has been a growing wave of criticism and alternative approaches to the dominant STI model within the realm of global climate and environmental governance. This is the first trend recognized in this policy brief. Countries - particularly those of the Global South -, vindicate less verticalized policies and paradigms, with civil society organizations and social movements following suit and calling for changes. This has led to criticism of the lack of efficacy of the LPCCC's core instruments and limitations, including its underrepresentation of Global South authors and subpar inclusion of local knowledge. Examples of contesting include endogenous innovation strategies of African and Asian countries, as well as Global South countries' participation in negotiation blocs. Some major achievements are worthy of mention, particularly the establishment of the LCIPP, although it continues to face structural hurdles.

5. TREND NO. 2: THE GROWING RECOGNITION OF THE DUAL ROLE OF STI

he second trend recognized in this brief is the growing recognition of the ■ "dual role" of STI, in which science, technology, and innovation policies are neither necessarily inclusive nor distributive. Conversely, they can be and often have been -, instruments for concentrating power and resources. Since Rio 92, STI has often been framed as a panacea for global environmental problems. Technology transfer and scientific cooperation, coupled with market-based solutions to address the climate and environmental crisis, have been steered by the assumption that technological diffusion and scientific advancements would uniformly benefit all nations, thereby bridging the gap between the Global North and South. Examples include the Clean Development Mechanism (CDM) under the Kyoto Protocol, which sought to facilitate the transfer of renewable energy technologies to developing countries, and policies under the CBD aimed at promoting biotechnology for biodiversity conservation. However, these approaches do not always account for structural asymmetries that shape the production, access, and impacts resulting from these technologies.

At the same time, there is a parallel process taking place since the Rio 92 Summit that challenges the aforementioned technoscientific view by pointing out that the dominant STI arrangements and frameworks are far from denoting a silver bullet for climate and environmental challenges. It has become increasingly clear that STI plays an ambiguous role in these realms, bearing intricate challenges for the ecological crisis, and the other way around as well. While STI has enabled significant progress in areas such as renewable energy, climate modeling, and ecosystem monitoring, it has also introduced new risks and dilemmas. More recent discussions, including around geoengineering, reflect growing concern that technologies like solar radiation management or carbon dioxide removal may pose ethical, environmental, and governance risks⁴⁵.

Still on the subject of the "dual role" of technology, other significant examples are evidenced under the CBD, which from its very outset has recognized the risks of unregulated technological interventions - namely, through its embrace of the precautionary principle (Principle 15 of the Rio Declaration).

This acknowledgment, however, only materialized in the Cartagena Protocol on Biosafety (2000), which focuses specifically on the risks of modern biotechnology, including genetically modified organisms (GMOs). The Protocol institutionalized risk assessment and management processes, highlighting that while biotech could contribute to conservation and sustainable use of biodiversity, it could, on the other hand, also threaten it – as well as potentially posing risks to local livelihoods if not properly governed.

5.1. CONVENTION INSTRUMENTS AND THE UNFCCC TECHNOLOGY MECHANISM

Under the UNFCCC, while early negotiations framed technology almost exclusively as a tool for mitigation and adaptation, a more nuanced view on the role that technology plays in the climate agenda emerged by the time of the 2010 Cancun Agreements. The result was the establishment of the Technology Mechanism, which encompasses the Climate Technology Centre and Network (CTCN) and the Technology Executive Committee (TEC). Importantly, the Technology Mechanism's mandate includes not only promoting the development and transfer of climate technologies, but also assessing their appropriateness, sustainability, and potential negative impacts, which are critical in allowing for the ethical inclusion of STI in the climate agenda.

As already mentioned, the Technology Mechanism was officially established in 2010 through Article 10 of the Paris Agreement. The wording of the document highlights its importance for mitigation and adaptation measures, particularly through cooperation efforts aimed at technological development and technology transfer. The article further defined the framework responsible for steering the mechanism, while signaling that it may play a strategic role in the implementation of the Paris Agreement and the development of a long-term perspective for the climate agenda.

At COP24 held in Katowice, Poland, in 2018, both the TEC and CTCN, devised under the umbrella of the mechanism, were further operationalized.

Their frameworks began to be arranged around five core themes, namely, innovation; implementation; creation of enabling environments and capacity-building; cooperation and stakeholder engagement; and overall support. The Katowice decision further pointed to the importance of expanding and disseminating emerging climate technologies, in addition to the pressing need to drive and consolidate technological innovation⁴⁶. A couple of

46. UNFCCC. Enhancing climate technology development and transfer through the Technology Mechanism, Decision -/CP.24,. https://unfccc.int/sites/default/files/resource/cp24 auv tm.pdf.

years later, in 2021, during the Glasgow-held COP25, the parties decided on expediting the development and dissemination of technologies geared towards the transition of low emissions energy systems. At the time, the importance of deploying cooperative measures and sustainable, adequate, and predictable funding was also deemed of the utmost importance⁴⁷.

Composed of 20 experts, the TEC runs as the "political branch" of the mechanism and is tasked with assessing issues related to climate technologies and devising country-specific policy recommendations. The CTCN, in turn, works as the "implementation branch," aimed at driving and coordinating technological cooperation. It runs based on three core tenets: providing technical assistance; promoting access to scientific information; and fostering collaboration among climate technology stakeholders through its network of national, regional, sectoral, and international organizations. In addition to its team of 20 experts, the CTCN has a 30-member advisory board⁴⁸.

At COP27, in 2022, the Joint Work Programme of the UNFCCC Technology Mechanism was launched with the goal of recognizing common areas of work, defining joint activities between the TEC and the CTCN, and thereby expediting the implementation of climate technologies. Some of the common areas mapped out so far include national innovation systems, energy systems, resilient infrastructure, and Technology Needs Assessments (TNA)⁴⁹. Joint activities consequently entail things like drafting Technology Roadmaps, with their rollout having included initiatives such as joint sessions between the TEC and the CTCN Advisory Board, development of joint systems, monitoring and evaluation, as well as data and technical information sharing. Examples include the joint work of the TEC and the CTCN on the 2021-issued Nationally Determined Contributions (NDCs), featuring an analysis of the technological challenges embedded in the targets and the collaboration of both bodies, with the UNFCCC secretariat's gender team tasked with devising gender-responsive technology policies.

^{47.} UNFCCC. Glasgow Climate Pact, Decision -/CP.26, 2021, https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf.

^{48.} UNFCCC. Joint Work Programme of the UNFCCC Technology Mechanism for 2023-2027, Framework Convention on Climate Change, 2022, https://unfccc.int/ttclear/misc / StaticFiles/gnwoerk static/TEC_key_doc/525876375aa8467eb6379f868b925e49/51b7785f86b54889837fecbcb7aecb6b.pdf.

^{49.} UNFCCC. Joint Work Programme of the UNFCCC Technology Mechanism for 2023-2027, Framework Convention on Climate Change, 2022, https://unfccc.int/ttclear/misc /StaticFiles/gnwoerk static/TEC_key_doc/525876375aa8467eb6379f868b925e49/51b7785f86b54889837fecbcb7aecb6b.pdf.

Although the Technology Mechanism and its instruments were originally envisioned to drive climate action, they appear to lack the momentum required to position technology as a true catalyst of this process - or, for that matter, even to ensure an effective technology transfer, something deemed critical for climate action since the very establishment of the UNFCCC. The current framework tends to fall short in addressing central challenges associated with inequality, as will be discussed in detail further on, and also lacks sufficient traction to boost innovation networks and infrastructures. Deenapanray and Trærup⁵⁰ also point out significant limitations in both the TEC and the CTCN and, more specifically, critique the approach used in the Technology Needs Assessments. The authors argue that there are current structural, methodological, financial, and institutional constraints that hinder the efficacy of the instruments. The scarcity of resources restricts the scope of action of the instruments, while concurrently stifling the engagement of strategic actors. The linear and sequential approach employed within these spaces, structured in three stages - identification, analysis of hurdles, and development of action plans -, hinders integration between the different stages and compromises outcomes. In addition, there are existing political challenges, including the limited integration of action plans with other climate policies like the NDCs. The result is that many of the policies fail to provide for key climate funding criteria required by major global funds, such as the Green Climate Fund.

The absence of more tangible agendas, such as those geared towards technology co-development, showcase not only an inadequate technology transfer, but also the lack of more inclusive perspectives and commitment to equality in the mechanism's methods. Another significant gap is the lack of initiatives specifically focused on social technologies, ancestral knowledge, and the practices of Indigenous Peoples and traditional and local communities. Moreover, there is limited interaction between the mechanism and other relevant spaces both in and outside of the Convention, such as the Subsidiary Body and the IPCC itself. What ensues is a fragmented system with a modest coordination capacity, as well as conceptual and operational shortcomings that have yet to successfully drive forward climate action-focused technologies.

Amid this context, the **Technology Implementation Programme (TIP)** emerged in 2023 during COP28, held in Dubai, as an outcome of the first Global Stocktake⁵¹. The TIP aims to expand support for the implementation of priority technologies identified by countries and to address the challenges highlighted in the initial reports of the Technology Mechanism. In the following year, at COP29 in Baku, the development of the programme was approved, with the process officially launched during the Bonn Conference in June 2025⁵².

For the TIP to be effectively implemented, countries must reach an agreement on its scope, mandate, funding sources, and mechanisms for coordination with other institutions within the UNFCCC's technology ecosystem. Although three documents were produced during the Conference⁵³, negotiations made limited progress due to divergences among the parties. Key points of contention included the programme's level of ambition, issues such as financing, the definition of eligible technologies, and the overall structure of the TIP. In the absence of consensus, a decision was made to keep the issue on the agenda of the **63rd Session of the Subsidiary Bodies (SB63)**, to be held in Bonn in 2026⁵⁴.

5.2. THE INCREASING COMPLEXITY OF THE "DUAL ROLE" OF STI IN THE 21ST CENTURY

Over the past two years, UNFCCC-related discussions about the ecological and climate footprint of new technologies, which is expected to increase exponentially in light of the digital revolution, have intensified, in particular over the rapid growth of AI and cloud computing. Not only have these innovations led to steep increases in water and energy consumption,

^{51.} UNFCCC. Decision 1/CMA.5, paragraph 110. Technology development and transfer, https://unfccc.int/sites/default/files/resource/cma2023_16a01_adv_.pdf#page=14.

^{52.} UNFCCC. Decision 18/CMA.6. Technology implementation programme, https://unfccc.int/sites/default/files/resource/cma2024_17a03_adv.pdf#page=10.

^{53.} UNFCCC. Draft Workplan -/CMA.7 Technology implementation programme, Version 19/6/2025, https://unfccc.int/sites/default/files/resource/TIP_dt_sb62_0.pdf

UNFCCC. Draft Workplan -/CMA.7 Technology implementation programme, Version 21/6/2025, https://unfccc.int/sites/default/files/resource/TIP_dt_sb62_02.pdf

UNFCCC. Draft Workplan -/CMA.7 Technology implementation programme, Version 24/6/2025, https://unfccc.int/sites/default/files/resource/TIP_dt_sb62_1.pdf.

^{54.} More information available on: Resumão LACLIMA - Conferência de Bonn 2025: https://www.laclima.org/publicacoes/resumaolaclima-sb62.

especially due to the growing demand for data centers, but future projections point at even higher levels - contributing to the very problem these technologies aim to solve. In conjunction, there has been an increasing need for strategic minerals that are critical for digital technologies, such as lithium, nickel, and rare earths, driven by a new extractive race spearheaded by major economies - which, once again, puts Global South spaces and territories at risk.

In addition, new STI-related challenges in addressing the ecological crisis arise from the fact that, in the absence of inclusive governance, STI can not only further deepen existing inequalities and injustices but also introduce new ones altogether. For instance, the deployment of large-scale renewable energy projects, such as solar farms and wind turbines, has sometimes resulted in land-use conflicts, displacement of local communities, and substantial ecological disruptions. These unintended consequences and overlooked impacts underscore the need for a more holistic and cautious approach to STI - one that considers both its potential benefits and its risks within the context of the ecological crisis. It is therefore imperative to consider that the STI agendas, especially the emerging technologies of the digital revolution, pose risks to both nature and people if not governed and managed responsibly. In the absence of adequate regulation and weakened safeguards by major platforms, AI has tended to facilitate the spread of disinformation by climate denialism blogs and far-right groups, as well as attacks on environmental causes and actors⁵⁵.

Additional concerns entail the impact of STI on socioeconomic inequalities, both within and across countries. While developed countries have reaped the benefits of technological advancements, developing ones - particularly Low-Income Countries (LICs) -, continue to face considerable barriers to accessing and utilizing these innovations. **The geography of innovation, after all, remains highly concentrated in rich countries**. These disparities are both rooted in, and feed into, structural inequalities, including limited financial resources, inadequate infrastructure, and insufficient capacity-building support. While wealthy nations deploy advanced climate models (often AI-driven) and renewable energy systems, many vulnerable communities in LICs still lack basic access to electricity and suffer from energy poverty.

Paradoxically, initiatives introduced to push for greater equality in negotiations under the Conventions have, at times, been co-opted with the aim of erecting new barriers. Over the past two years, the concept of a "just transition"- now the object of a work programme within the UNFCCC -, has increasingly been leveraged by rich countries to reinforce their dominance in cutting-edge technologies and low-carbon economic transformations, often at the expense of developing countries⁵⁶. The concept of a just transition was initially used by trade union movements and restricted to discussions around the creation of new jobs for workers in the fossil fuel industry⁵⁷. Over time, however, the concept has become broader and come to reflect the kind of transition to be pursued. Furthermore, it now encompasses additional elements that go beyond the safeguarding of labor rights, including the promotion of sustainable development, poverty eradication, and the recognition of needs that are specific to vulnerable groups.

While developed nations frame their transition to renewable energy and green industries as a pathway to sustainability and equity, in practice, they have leveraged their technological and financial advantages to consolidate control over key sectors such as Al-driven energy management, battery energy storage systems (BESS), green hydrogen, and biotech-based climate solutions. Many of these countries implement aggressive green industrial policies, including extensive subsidies, state-backed research and development, and strong intellectual property protections, positioning themselves as leaders in the low-carbon economy and securing geopolitical benefits by controlling supply chains, critical minerals, and high-value STI ecosystems⁵⁸.

At the same time, these same nations impose trade barriers, carbon border taxes, and restrictive intellectual property regimes that limit developing countries' access to crucial technologies needed for their own green transformations. They are, in essence, leveraging the concept of sustainability as a means to "kick away the ladder" once more, in a re-edition

^{56.} Mattos, B.; Folly, M. From the G20 to the UNFCCC: Pathways to Just and Inclusive Transitions, Plataforma CIPÓ, 2025, https://plataformacipo.org/wp-content/uploads/2025/06/web_CIPO_PB_TRANSICAO-JUSTA-1.pdf

^{57.} Johansson, V. Just Transition as an Evolving Concept in International Climate Law, Journal of Environmental Law, 2023, 35, 229-249, https://doi.org/10.1093/jel/egad017.

^{58.} Telésforo, J. O regime internacional de propriedade intelectual como obstáculo à transição energética no Sul Global: a proposta de quebra de patentes de tecnologias verdes, Nota de Política Econômica, Made centro de pesquisa em macroeconomia das desigualdades, 069, 2025, https://madeusp.com.br/wp-content/uploads/2025/05/npe69-PATENTESVERDES-1.pdf.

of the dynamic whereby dominant powers secure their own development while restricting the opportunities for others to follow suit⁵⁹. By doing so, Global North countries frame sustainability as an essential and noble pursuit, yet simultaneously impose stringent regulations, economic barriers, or ideological constraints that prevent developing nations or emerging competitors from achieving similar levels of industrial and technological progress. This tactic allows them to maintain their privileged position in the international system while justifying their actions under the guise of environmental or ethical responsibility.

This dynamic was evident, for example, in discussions around the implementation of technology transfer mechanisms under the UNFCCC. Despite commitments in the Rio Conventions to facilitate equitable access to climate-related STI, developed countries resisted efforts to establish robust frameworks for open-source technology sharing, instead favoring market-driven approaches that prioritized the interests of multinational corporations. The difficulty in operationalizing the Technology Mechanism and the CTCN further reflects these tensions, as funding gaps, intellectual property barriers, and political resistance have hampered meaningful technology transfer to the Global South. As a result, many developing nations remain constrained in their ability to implement their own green industrial policies and build independent STI capacities, thereby reinforcing a global system in which the benefits of green technological leadership and the geopolitical influence it brings -, remain concentrated in the hands of wealthier nations.

While the principle of CBDR underscores the obligation of developed countries to support developing nations in their climate efforts, in practice, the translation of this principle into actionable mechanisms has been inconsistent, including in relation to STI. Within the context of this agenda, the CBDR-RC should be effected through the transfer of technologies from the Global North to South – a long-standing demand of developing nations and a core element for the promotion of equity at the global level. However, hands-on experience has repeatedly shown that relying solely on this mechanism has failed to yield the expected results.

59. Lebdioui, A. Survival of the Greenest: Economic Transformation in a Climate-Conscious World, Cambridge University Press, 2024, https://doi.org/10.1017/9781009339414.

Chang, H. *Kicking Away the Ladder*: Development Strategy in Historical Perspective, Anthem Press, London, 2002, https://fenix.iseg.ulisboa.pt/downloadFile/1688983004255200/Kicking%20Away%20the%20Ladder%20

Not only has technology transfer failed to materialize effectively, but the premise that solutions are concentrated in developed nations proves to be far-fetched. This is explained by the fact that, despite the historical concentration of industrial and technological production in the Global North, the Global South has devised solutions - both low and high-tech -, that deserve greater visibility and scaling potential. Several important innovations already exist in the Global South, especially in local and traditional territories and communities, though they lack funding and institutional frameworks to ensure their maintenance, reproduction, and expansion. As a result, many developing nations face ongoing hardships in accessing critical technologies for climate mitigation and adaptation, which, in turn, only further bridges the gap between developed and developing countries. STI agendas, consequently, ultimately end up working as an additional layer of reproduction of sustainable development-related disparities. At the same time, the very concept of responsibility remains the subject of debate - and continues to be an unresolved dilemma.

Moreover, when the deployment of STI solutions fails to account for the unique social, cultural, and economic contexts of developing countries, they can cause more damage than good. High-tech solutions designed in the Global North may not always be suitable for rural communities in LICs, where infrastructure and technical expertise is often limited. This mismatch can lead to the adoption of inappropriate technologies, further marginalizing vulnerable populations. Given the failure in the effective materialization of technology transfer and the recognition of its shortcomings, there is an increasing need to explore other pathways, including technology codevelopment, which in and of itself raises a range of new issues as well as unanswered questions. To address these challenges, there is a growing call for context-specific innovations that integrate local knowledge systems and prioritize the needs of marginalized communities. Initiatives like the Technology Facilitation Mechanism (TFM) under the 2030 Agenda emphasize the importance of inclusive and participatory approaches to STI, ensuring that technological advancements are equitable and socially just.

The recognition of STI's complex consequences has also sparked a broader discussion about the ethics of innovation. Jasanoff⁶⁰ uses the concept of "technologies of humility" to advocate for a more reflective and inclusive

^{60.} Jasanoff, S. Technologies of Humility, *Nature*, 2007, 450, 33, https://doi.org/10.1038/450033a.

approach to science and technology. This perspective emphasizes the importance of considering the social, ethical, and distributive dimensions of technological advancements, rather than focusing solely on their technical efficacy and promise. In the context of climate and environmental governance, "technologies of humility" call for greater participation of diverse stakeholders, including Indigenous Peoples and traditional and local communities, civil society organizations (CSOs), and local governments, in the design and deployment of STI solutions.

As previously discussed, the CBD's emphasis on biotechnology for biodiversity conservation has, for instance, raised ethical concerns about the equitable sharing of benefits and the inclusion of Indigenous knowledge. In many cases, corporations and research institutions from wealthier nations leverage advanced biotechnological tools to market and sell genetic resources derived from biodiversity-rich regions, often located in the Global South. However, Indigenous Communities and traditional and local communities, who have safeguarded and cultivated these resources for generations, frequently find themselves excluded from decision-making processes and denied a fair share of both the economic and scientific benefits. This dynamic mirrors historical patterns of resource extraction, in which wealthier nations dictate the terms of access and control, consequently reinforcing existing power imbalances under the pretense of sustainability and conservation. These challenges highlight the need to approach STI in ways that prioritize transparency, accountability, and community engagement, as articulated in subsequent international agreements and protocols.

Against this backdrop, the second trend recognized in this policy brief is the growing acknowledgement of the "dual role" of STI, in which agendas designed to address the climate crisis may, at the same time, risk reproducing or even exacerbating existing inequalities. Starting from Rio 92, STI policies were framed as means of progress; however, experiences such as the Clean Development Mechanism and the Cartagena Protocol evidenced that these technologies could bear detrimental ecological impacts, particularly in the absence of appropriate regulations. Mechanisms like the CTCN and the UNFCCC's TED sought to solve the issue, but their scope is constrained by their limited effectiveness and institutional fragmentation, especially in the Global South. At the same time, emerging technologies like Al and renewable

energies have themselves yielded new risks, including excess consumption of resources and local conflicts. Developed nations have deployed the just transition agenda to bolster their technological stronghold, thereby restricting access to technologies through trade barriers and intellectual property mechanisms. As a result, there is an increasing demand for alternate means of innovation, such as technological co-development and the strengthening of local knowledge, in the pursuit of a more just and equitable ecological transition.

6. TREND NO. 3: SETTING THE PARAMETERS OF THE SYNERGY AGENDA: IMPLICATIONS FOR STI

The third major trend in the progress of global environmental governance is the renewal of the so-called "synergy agenda" - a set of measures aimed at recognizing, coordinating, and addressing the multiple interactions and overlaps between the Rio 92 Conventions. This agenda acknowledges that climate change, biodiversity loss, and land degradation are deeply interconnected challenges that cannot be addressed in isolation. For example, climate change exacerbates biodiversity loss, which, in turn, weakens ecosystem resilience and contributes to land degradation. Similarly, efforts to restore degraded lands can enhance carbon sequestration, benefiting both climate and biodiversity goals. In recognizing such linkages, the synergy agenda has driven calls for greater policy coherence, joint implementation strategies, and integrated monitoring systems.

It must be noted that the synergy agenda is not new. Since its inception, the Rio 92 Conventions were designed as separate but interrelated legal frameworks - each addressing distinct yet significantly overlapping challenges. In 2001, a Joint Liaison Group (JLG) was established by the secretariats of the CBD, UNFCCC, and UNCCD. The key idea was to integrate approaches such as ecosystem restoration to contribute to all three agendas simultaneously. The JLG remains the main official mechanism for promoting synergies among the Rio Conventions and has produced a series of progress reports as well as technical notes on areas of cooperation, including ecosystem-based approaches, capacity building, and joint reporting.

In practice, however, the impact and tangible results of the JLG have been limited. While it has helped raise awareness of the need for inter-convention cooperation and produced informative joint reports, it lacks the mandate, institutional capacity, and visibility to enforce synergies on the ground. In addition, because each convention has its own COP, subsidiary bodies, and financial mechanisms, the JLG is not mandated to oversee budgets or make official decisions. This limits its role to facilitating discussions rather than leading on programmatic integration. As a result, the JLG's work remains largely at the level of voluntary exchange of knowledge, without strong follow-through in international cooperation, national policies, or implementation frameworks.

Subsequent negotiations, such as the Johannesburg Plan of Implementation (2002) and the Rio+20 outcome document "The Future We Want" (2012), acknowledged that the challenges addressed in the different Rio 92 negotiations are deeply interconnected. The separate conventions have allowed for focused international action on critical environmental issues, yet sometimes the separate tracks reinforced fragmented and unnecessarily rigid policy silos that hinder integrated, cross-sectoral approaches to sustainability.

In recent years, there have been renewed calls for a synergy agenda, including in the lead-up to COP30. In May 2023, the Expert Group on Climate and SDG Synergy was co-convened by UN DESA and the UNFCCC Secretariat, comprising 14 renowned experts from diverse backgrounds. Their pivotal task was to draft the First Global Report on Climate and SDG Synergies. The following year, the focus on climate and biodiversity synergies gained renewed momentum, thanks largely to high-profile events emphasizing the need for integrated, cross-sectoral approaches. The 5th Global Conference on Climate and SDG Synergies, hosted in Rio de Janeiro in 2024, brought together UN agencies, governments, and civil society to discuss actionable strategies that align climate action with the 2030 Agenda, including Nature-Based Solutions (NbS) and ecosystem restoration.

Still in 2023, during the Synergies Day at the 6th Capacity-Building Hub during COP28, the Member States showcased practical examples of how countries have begun seeking to align their Nationally Determined Contributions (NDCs) with National Biodiversity Strategies and Action Plans (NBSAPs), reinforcing the call for a whole-of-government and whole-of-society approach. Nearly 30 countries and coalitions endorsed the "COP28 Joint Statement on Climate, Nature, and People," advocating for integrated approaches to address climate change and biodiversity loss⁶¹.

Since 2022, the synergy between the conventions has been a negotiation point at the CBD COPs. However, despite political will, no major resolutions were achieved under the Kunming-Montreal Global Biodiversity Framework. In Cali, Colombia, during COP16, significant progress was made with the approval of a resolution calling for strengthened cooperation between the scientific bodies of the climate and biodiversity conventions. The resolution further highlights the need to ensure that NBSAPs and other Multilateral Environmental Agreements (MEAs), including NDCs, are aligned. The

^{61.} UNFCCC. COP28 Joint Statement on Climate, Nature and People, 2024, https://www.unccd.int/sites/default/files/2024-07/COP28%20Joint%20Statement%20on%20Climate%2C%20Nature%20and%20People.pdf.

UNFCCC, however, has lagged behind compared to the CBD and displayed more modest developments in its resolutions aimed at integrating the conventions⁶². Despite this relative sluggishness, ongoing initiatives not only advanced the technical dialogue on implementation of synergies but also helped set the stage for deeper coordination ahead of COP30 in Belém, where the synergy agenda is expected to feature prominently.

STIplays a pivotal role in advancing synergies between the Rio 92 Conventions and the 2030 Agenda. On the one hand, it offers tools, methodologies, and approaches that address interconnected environmental challenges in an integrated manner. Remote sensing technology, for example, has supported climate adaptation under the UNFCCC, enabled biodiversity monitoring under the CBD, and shared sustainable land use standards under the UNCCD. Similarly, advances in data science and modeling have helped policymakers recognize co-benefits and trade-offs among mitigation, conservation, and development strategies, thereby supporting more coordinated implementation across national plans.

The synergy agenda also provides an opportunity to integrate Global South perspectives and Indigenous Peoples and local community knowledge systems into global environmental governance. As previously discussed, STI has been historically dominated by Western-centric, unilateral technology transfer-based high tech solutions developed in the Global North. This top-down approach was evident in the early implementation of the Rio 92 Conventions, during which technology transfer commitments under the UNFCCC and the CBD were hindered by intellectual property restrictions, lack of financial support, and limited capacity-building initiatives for developing countries. In contrast, the synergy agenda emphasizes the importance of context-specific innovations that integrate traditional knowledge, local practices, and grassroots solutions.

Examples include initiatives like the Great Green Wall Initiative, supported by the UNCCD, which merges satellite technology and traditional knowledge to combat desertification across the Sahel region, as well as Brazil's "Arc of Restoration," led by the Brazilian Development Bank (BNDES), which seeks to reverse widespread deforestation across a vast swath of the Brazilian Amazon. These initiatives may help combat climate change and reverse biodiversity loss, while generating jobs and income for local populations. Moreover, the synergy agenda may help shape STI policy by encouraging

62. UNFCCC. Synergies between biodiversity - and Climate - Relevant Policy Frameworks and Their Implementation, a Series of Thematic Papers, GIZ, 2024, https://unfccc.int/sites/default/files/resource/Synergies_Between_Biodiversity-and_Climate-Relevant_PolicyFrameworks_and_Their_Implementation.pdf.

innovation that is inclusive, problem-driven, and locally grounded. A concrete example is the incorporation of Indigenous Integrated Fire Management (IFM) methods into national wildfire prevention strategies in Australia and Brazil, which combine scientific methods with ancestral ecological knowledge to enhance ecosystem resilience. The synergy agenda thus ensures that STI contributes not only to environmental and climate goals, but also to social equity and capacity-building, particularly in the Global South.

However, before the synergy agenda can fully meet its potential, it is first necessary to overcome the selective and fragmented enforcement of commitments taken on at Rio 92 and replace it with a broader and more integrated view of sustainable development - the same one that served as inspiration for the conventions from the very start. The 2030 Agenda approach seems to point to interesting pathways by endeavoring to balance out the environmental, social and economic realms of sustainability. The 2030 Agenda framework and its 17 Sustainable Development Goals (SDGs), after all, further reinforce the need for synergy. Key SDGs, such as SDG 13 (Climate Action), SDG 14 (Life Below Water), and SDG 15 (Life on Land) align closely with the mandates of the Rio conventions. However, the synergy agenda must extend beyond these environmental goals to encompass development objectives such as No Poverty (SDG 1), Sustainable Cities and Communities (SDG 11), and Responsible Consumption and Production (SDG 12). This holistic approach recognizes that environmental governance cannot be severed from social and economic imperatives and that STI must be leveraged to address these interconnected challenges. In fact, removing the 2030 Agenda from the synergy agenda risks entrenching a narrow, technocratic approach that favors high-tech environmental solutions over social justice, economic equity, and local adaptation capacities. This mindset, and it alone, will help ensure that the synergy agenda, in the path leading up to COP30, contributes to mitigating social and environmental injustices - rather than deepening them.

Despite its potential, the synergy agenda faces significant challenges. Institutional fragmentation remains a major hurdle, as each convention operates under distinct mandates, funding mechanisms, and governance structures. Furthermore, competing national priorities and sectoral interests can impede coordinated policy implementation, particularly in developing countries where urgent economic and social issues may take precedence. Limited financial resources and technical capacities, as well as gaps in STI - especially within the context of weakening multilateralism and retraction in commitments by advanced economies -, further complicate efforts to develop harmonized strategies across the conventions. Insufficient STI

infrastructure can additionally hinder data sharing, technology transfer, and the adoption of innovative solutions that could enhance synergy. The scenario takes a turn for the worse, though, whenever synergies are pursued solely as a means of cost-cutting, whereby the same funds are used to tackle multiple challenges at once, thus circumventing requirements of additionality of resources – a conduct that must be monitored and addressed under the agenda itself. Finally, recognizing and measuring synergies effectively remains a challenging task due to differing monitoring, oversight, and reporting frameworks, making it difficult to track progress in a unified manner.

In short, synergies between the Rio Conventions and the 2030 Agenda can amplify the positive, distributive side, as well as reinforce the detrimental, concentrative-like aspects of STI – subject entirely to how these agendas are interpreted, framed, and implemented. This underscores the need for STI to be approached not as a top-down, one-size-fits-all solution, but rather through inclusive, context-sensitive processes that acknowledge diverse knowledge systems and put equity at the forefront of global environmental governance.

7. A CASE IN REGIONALIZATION: THE BELÉM DECLARATION AND PAN-AMAZONIA

ar from being mutually exclusive options, the three trends addressed in this policy brief instead converge in shaping a critical view of how STI has been integrated into global climate and environmental governance. These critiques have caused a shift in approach across various realms, which, at times, can be reflected in commitments made by countries. This is the case of the Belém Declaration, signed in August 2023 during the Amazon Summit, the official meeting of the heads of state of the eight Amazonian countries that comprise the Amazon Cooperation Treaty Organization (ACTO)⁶³.

The Amazon Summit and, in particular, the signing of the Belém Declaration, played a pivotal role in renewing the Pan-Amazonian cooperation agenda. Featuring more than a hundred paragraphs, the declaration aims to expand and strengthen cooperation among Amazonian countries and encourage collective measures to address social, economic, political, and environmental challenges, in order to prevent the Amazon from reaching the point of no return – that is, a critical threshold that, if exceeded, could lead to abrupt changes in the forest's landscape and life. The Amazon Dialogues were held in parallel with the summit of the heads of state, bringing together civil society, Indigenous Peoples and traditional and local communities from the region to discuss subjects related to the socio-environmental and political issues of the Amazon Biome and its peoples, and to submit proposals to the heads of state of the Amazonian countries.

With regard to STI, the Belém Declaration provides a set of 13 commitments grouped under the heading "Science, Education and Innovation: Knowledge and Entrepreneurship in the Amazon," 64 which address the region's

^{63.} The Amazon Cooperation Treaty Organization (ACTO) was established in 1995, stemming from the Amazon Cooperation Treaty signed in 1978 by the eight countries comprising the Amazon: Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela. Although ACTO was instituted in 1995, its Permanent Secretariat was only officially established in Brasília in 2002.

knowledge management policy. Its first provision, set out in paragraph 16, concerns the establishment of the Amazon Intergovernmental Technical-Scientific Panel under the framework of ACTO. The purpose of the panel is to bridge the gap between researchers and scientists from Member States and to encourage the exchange and systematization of Amazon-specific information, especially information to help tackle deforestation and prevent environmental injustices. In addition to the panel, the Declaration calls for the institution of an Innovation and Technology Diffusion Network, a locus for the joint development of solutions to the challenges of promoting sustainable development in the region.

Throughout this policy brief, the commitments related to the STI agenda can be grouped into the following categories: measures to promote the technical and technological capacities of the Member States; cooperation between scientific institutions and actors; technical assistance provided to traditional peoples and communities; and support for academic capacity-building in socio-environmental subjects. Rather than being confined to this sole thematic axis, STI cuts across the entire text of the Declaration. One such example is the call to expand the Amazon Regional Observatory (ARO), which comprises the thematic axis focused on strengthening ACTO's institutional capacity. Several other paragraphs take the discussion further, however, and emphasize the need to develop and integrate technologies into policies for combating deforestation, protecting biodiversity, tracking illegal activities, fire management, water monitoring, prevention and mitigation of extreme climate events, and sustainable ecosystem management. The Declaration additionally acknowledges that while the debate around new solutions and technologies is essential, Amazonian countries already have in place innovative approaches that must be shared. There is therefore a pressing need to streamline political mechanisms, promote technological inclusion, and eliminate digital, capacity-building, and access gaps in technological resources across countries - all of which require coordinated and ongoing cooperation efforts.

In addition to the commitments grouped under the heading "Science, Education and Innovation," the Declaration brings 31 other agendas that, whether directly or indirectly, relate to STI. However, what makes the Declaration particularly relevant for examinations and discussions on STI in the Global South is not the number of references it brings. Instead, what makes it stand out are the principles steering its commitments, namely, an approach

^{64.} It is worth noting that the provision dedicated to the STI agenda prioritizes the word "education" in its title, rather than "technology." A closer look at the commitments grouped under this thematic axis reveals that, in most cases, the focus lies in expanding scientific research infrastructure and networks in the Amazon, as well as enhancing the technical capacities of researchers and educators in the region.

that is less top-down and more centered on the exchange of technologies among Global South countries, acknowledgement of Indigenous, local and traditional knowledge, and alignment with the synergy agenda.

Even as it urges developed countries to fulfill their obligations in affording access to technology to developing nations, the Declaration seemingly moves away from previous frameworks that privileged hierarchical and technocratic solutions stemming from the Global North. In an attempt to challenge this view, which almost singlehandedly associates STI with the transfer of high-tech solutions from the North to the Global South, the document highlights the importance of innovations that are tailored to the Amazon's current environmental and sociocultural conditions. This brief thus seems to exemplify approaches that view STI as an intricate tool that must be context-sensitive.

The Declaration also embeds a call for the acknowledgment of the participation and knowledge of Indigenous Peoples and traditional and local communities across many of its commitments, underscoring the importance of inclusive technological innovation that ensures technological advancements engage with - and benefit -, all relevant stakeholders. In calling on Amazonian countries to exchange knowledge, technologies, and experiences among each other, the Declaration seeks to encourage the protagonism of Global South nations as well as Indigenous Peoples and traditional and local communities in the co-development of contextappropriate solutions. Examples include proposals for the creation of the Rural Women's Observatory for the Amazon under ACTO and the Forum of Indigenous Peoples and Local and Traditional Communities, also within the framework of ACTO - though specifically under its Indigenous Peoples' Mechanism -, envisioned as a platform for debate and mobilization to help further technologies geared towards the preservation and sustainability of the Amazon.

This set of commitments opens up new pathways to ensure greater protagonism for Global South countries as well as for Indigenous Peoples and traditional and local communities in the co-development of context-appropriate solutions. Furthermore, it allows for the acknowledgment of the role of traditional knowledge in biodiversity conservation and sustainable land management by recognizing that Indigenous practices often offer valuable insights into ecosystem resilience and climate adaptation. The commitments set forth in the Belém Declaration are therefore closely interconnected with the first trend recognized in this study, that is, its approach to STI goes against the vertical, top-down rationale. Moreover, the empowerment of Indigenous communities and local stakeholders, as advanced by the Belém Declaration, reflects a broader commitment to ensuring that technological advancements are not only effective but also equitable and socially just. To

that end, it also resonates with the second trend discussed in this policy brief, as it finds that STI systems are not necessarily neutral in nature and should instead serve the cause of social justice.

The Belém Declaration is also entwined with the third trend addressed in this brief: the renewal of the synergy agenda. Among its principles, the document recognizes the interconnectedness of climate change, biodiversity loss, and land degradation, calling for integrated solutions that address these challenges holistically. An example of this is the Amazon Regional Observatory (ARO), officially established in 2010 and tasked with collecting, analyzing, and sharing information about the Amazon. This initiative is attuned to the objectives of the Rio 92 Conventions, particularly the UNFCCC, CBD, and UNCCD, demonstrating how STI can serve as a bridge between these agreements.

Despite its potential, the effective implementation of the STI agenda within the Belém Declaration faces significant challenges, both globally and regionally. On the global stage, the weakening of multilateralism, sharpening geopolitical tensions and growing trade disputes over key technologies, such as AI, green hydrogen, and battery storage, complicate international cooperation on technology transfer and innovation. The increasing securitization of critical supply chains for clean energy technologies also risks reinforcing existing asymmetries between developed and developing nations, including Amazonian countries, some of which are home to substantial reserves of critical minerals.

At the regional level, political divergences among Amazonian countries create obstacles to coordinated STI policies, with differing national interests and governance priorities slowing down joint initiatives. Furthermore, inadequate financing remains a major barrier, as many Amazonian countries lack the necessary funding in research, infrastructure, and capacity-building to fully implement the Declaration's commitments. The absence of long-term, sufficiently robust funding from ACTO itself exacerbates the existing scenario. The reliance on external funding, often tied to conditions set by international institutions and donor countries, can limit the agency of Amazonian nations in shaping their own STI agendas. Overcoming these challenges requires sustained political will, increased regional cooperation, and innovative financing mechanisms that align with the needs and aspirations of local communities.

Efforts deployed to strengthen regional Amazonian cooperation, as laid out in the text of the Belém Declaration and its implementation, allow us to distinguish specific challenges that overlap with initiatives to bridge the gap between STI and environmental governance, as discussed in this policy brief. Based on these challenges, it is possible to envision pathways and recommendations for transforming this scenario.

8. FINAL CONSIDERATIONS AND RECOMMENDATIONS

The analysis developed throughout this policy brief allows for the recognition of a dominant paradigm steering STI policies in global climate and environmental governance. This top-down, or vertical, model has nevertheless failed to fulfill the role originally envisioned for STI in 1992: serving as an instrument of sustainable environmental policymaking. This verticalized paradigm has proven unable to address structural issues related to inequality, nor has it ensured an effective transfer of technology among countries, particularly those of the Global South.

Three broad trends can also be discerned from the analysis: 1) There is growing questioning of the hegemonic understanding of STI in recent agreements and outcomes. In particular, Global South countries and Indigenous constituencies and traditional and local peoples have been advocating for a less hierarchical, or top-down, approach to STI in climate and environmental negotiations. This trend, however, risks being reversed given the current state of debate about the digital revolution, especially Al. 2) There has been growing acknowledgement that STI bears complex and sometimes unforeseen consequences for climate and the environment, including exponentially increasing climate and environmental footprints, as well as considerable implications for socioeconomic inequalities. 3) There is a noticeable renewal of the "synergy agenda" - efforts to recognize, explore, and address the multiple overlaps between the Rio 92 Conventions (and equally important frameworks, such as the 2030 Agenda). The Belém Declaration offers an example of regionalization, reflecting, to some degree, all three trends recognized in the analysis, but, on the other hand, also facing challenges that are specific to the region - and pointing to potential solutions for STI policies centered on equitable and socio-environmental commitments.

In light of these trends, certain actions are more urgent. With this in mind, this document provides twenty recommendations to be implemented at both the international and national levels, aimed at decision-makers.

RECOMMENDATIONS - INTERNATIONAL LEVEL

Reinforcing synergies among the Rio Conventions

1.

Establishing a regulatory framework for the integration and strengthening of Indigenous, traditional, and local knowledge - including that of Afrodescendant populations and farming communities -, within the subsidiary and scientific bodies of the Rio Conventions. It is recommended that the scientific subsidiary bodies of the three conventions, namely, the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UN Framework Convention on Climate Change (UNFCCC), the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) of the Convention on Biological Diversity (CBD), and the Committee on Science and Technology (CST) of the UN Convention to Combat Desertification (UNCCD), recognize and integrate Indigenous, traditional, and local knowledge as legitimate and autonomous knowledge systems endowed with their own methodologies, philosophical pillars, regulations, and institutions. The establishment of a permanent subsidiary body for Indigenous Peoples under the CBD is an example of good practice that should be strengthened, along with the explicit recognition in the Convention and in the Global Biodiversity Framework of the pivotal role played by Afro-descendant communities. The establishment of a regulatory framework should take into account the following: a) the recognition and acknowledgment of Indigenous Peoples and traditional and local communities as actors and networks of actors who produce knowledge, technologies, and innovations; b) the critical review of dominant epistemological frameworks; c) the promotion of intercultural and interdisciplinary knowledge production models; d) the institution of ethical protocols and benefit-sharing mechanisms; and e) the assurance of qualified participation, especially through the Indigenous Caucus and other representative forums of traditional and local communities and Afrodescendant populations. The aim of these recommendations is to advance the official recognition of Indigenous, traditional, and local knowledge as an integral and legitimate part of knowledge production and innovation and technology paradigms, aimed at ensuring such knowledge is duly recognized and acknowledged in public policies on climate change, biodiversity, and desertification. In addition to officially recognizing traditional knowledge, public science, technology, and innovation (STI) policies should embed intercultural models of technical assistance and rural extension that draw on hands-on experience dealing with droughts and acknowledge longstanding adaptive practices of local populations.

- **Strengthening coordination and synergies among key science-policy bodies.** These include the IPCC, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and the Science-Policy Interface (SPI). The brief recommends that a working group be established to address the subject under the Joint Liaison Group, aimed at devising proposals for joint efforts among these entities. Potential collaborations may include data sharing, the joint development of cross-sectoral and transdisciplinary methodologies and indicators, and the production of co-authored publications.
- Creating an inter-convention protocol for the governance of climate and environmental data. This protocol should be steered by the following principles: FAIR (Findability, Accessibility, Interoperability, and Reusability), already used in platforms such as the Global Biodiversity Information Facility (GBIF) and the IPCC; CARE (Collective Benefit, Authority to Control, Responsibility, and Ethics), focused on fostering the informational sovereignty of Indigenous Peoples and traditional and local communities; and data interoperability, based on open standards that render possible not only communication across different platforms but also support data management within distributed, multisectoral governance arrangements. The protocol should further recognize and acknowledge citizen-generated data.
- Establishing a mechanism for integrated, effective, and dignified social participation of Indigenous Peoples, traditional peoples and communities, family farmers, and Afro-descendant populations in the three conventions. This policy brief recommends that a standing instrument be devised and run jointly by the CBD, UNFCCC, and UNCCD to ensure the continuous and dignified presence of representatives from these groups at all COPs and intersessional forums, especially from megadiverse regions such as Latin America and the Caribbean. Engagement of these groups in negotiation spaces is a key condition for ensuring that Indigenous, traditional, and local knowledge - often rooted in oral traditions -, is effectively disseminated. This mechanism should account for the following criteria: welcoming infrastructure, including food, transport, language interpretation, lodging, and appropriate common areas; coordinated accreditation policy that accommodates the specific needs of the groups, accounts for the social and cultural conditions of each country, and ensures access to all three conventions; ensuring the maintenance of the number of accreditations and preventing any reductions or rollbacks in participant numbers across different COP cycles; establishment of a continuous cycle

in negotiation processes across all three Rio Conventions; dedicated and streamlined funding mechanisms to enable said participation; coordinated strategy to safeguard the lives of leaders and advocates during travel and engagement in activities; and the design and implementation of learning pathways for capacity-building.

Strengthening synergies under the Convention on Climate Change

- Strengthening the Local Communities and Indigenous Peoples Platform (LCIPP) under the UNFCCC, with regard to and in cooperation with other Convention instruments and spaces, to ensure a more agile and effective response to demands. The implementation of the Baku Workplan of the Local Communities and Indigenous Peoples Platform implementation will be enhanced if its knowledge-related component is reinforced and if the platform is linked to and working together with bodies such as the SBSTA, IPCC, Indigenous Caucus, and the Technology Mechanism. Similarly, the platform can be further leveraged through constant engagement and dialogue with regional mechanisms associated with Indigenous Peoples and local communities, including those outlined in the Belém Declaration.
- Systems, tasked with serving as an interface between the LCIPP and the UNFCCC's subsidiary bodies. The establishment of an official mechanism of this nature, directly tied to the SBSTA, would help organize cooperation among distinct convention instruments, thereby ensuring that Indigenous and community knowledge systems are recognized as autonomous and legitimate means of evidence production. The initiative would additionally help address the current scenario of excessively decentralized and fragmented governance within the scope of the convention and its instruments related to STI and Indigenous Peoples and traditional and local communities. Active engagement of Indigenous Caucus representatives in this Working Group should be encouraged and strengthened, guaranteeing their direct influence in decision-making processes.

Rethinking technology transfer models and new innovation co-production models

- Reviewing the frameworks of instruments established under international conventions, such as the UNFCCC Technology Mechanism, to strengthen the endogenous capacities of scientific and technological development of Global South nations by reframing traditional hierarchical, or top-down, technology transfer models. This review must break with the dominant paradigm in multilateral spaces that distinguishes countries as "producers" or "consumers" of technology. It is therefore critical to promote the institutionalization of knowledge co-production and place-based innovation, recognizing local knowledge systems and acknowledging coordination between science, technology, and the specific needs of each territory. Furthermore, devising plural institutional arrangements—with the effective engagement of local stakeholders, research centers, Indigenous Peoples, and traditional communities—, is key to ensuring a just and context-sensitive transition.
- policies in climate vulnerability contexts. Under this recommendation, the suggestion is to develop and incorporate indicators that capture the social, environmental, and cultural impacts of technological innovations in an integrated manner particularly in Global South territories. Rather than merely replicating classical indicators like productivity or patents, these metrics should also incorporate variables such as local productive inclusion, food security, community empowerment, and territorial equity. The Manifesto for Socio-Territorial Metrics of STI⁶⁵ may serve as a methodological foundation for this purpose.

^{65.} ESOCITE; Latmétricas. Manifesto por Métricas Socioterritoriais da Ciência, Tecnologia e Inovação, 2024, http://eprints.rclis.org/45961/3/POR%20Manifesto%20por%20 M%C3%A9tricas%20Socioterritoriais.pdf.

- Promoting intersectoral approaches that integrate environmental governance with broader social and economic imperatives, thereby avoiding isolated technological solutions. Policymakers should respond to civil society's call for a sound review of impact indicators for Research & Development, allowing STI programs to simultaneously advance multiple SDGs, including agroecological innovation which, in turn, can improve food security indicators (SDG 2) –, enhance climate resilience (SDG 13), and support biodiversity conservation (SDG 15). Good practices include the European Union Science Missions^{66 67}.
- Accelerating and enhancing the implementation of the Joint Work Programme between the Climate Technology Centre and Network (CTCN) and the Technology Executive Committee (TEC) -, while ensuring greater space for new innovation-focused models of coproduction and cooperation under the UNFCCC Technology Mechanism. Implementation of the Technology Mechanism, tasked with undertaking the UNFCCC's technology framework, has progressed notably through the Joint Work Programme. However, its overall progress has been modest, and it operates with limited funding. Compounding the issue, the current work agenda offers little to no space for new innovative co-production models. It is therefore of the utmost importance to strengthen the scope of the Technology Mechanism by encouraging an approach capable of successfully responding to climate challenges.
- Addressing and mitigating financial barriers to enable a fairer distribution of green technologies across all developing countries and fostering innovation in the Global South. Funds and banks, such as the Inter-American Development Bank and the Amazon Fund, must recognize the importance of allocating significantly higher percentages to green technologies and expand access to such funds. Furthermore, governments and international organizations should establish funding mechanisms, legal safeguards, and policy instruments that recognize and ensure the intellectual property rights of Indigenous Peoples and local communities, particularly in light of the World Intellectual Property Organization (WIPO) Treaty on Intellectual Property, Genetic Resources, and Associated Traditional Knowledge, signed in 2024.

^{66.} International Science Council. Science Missions for Sustainability. International Science Council, 2025, https://council.science/our-work/science-missions/.

^{67.} Mazzucato, Mariana. Mission-oriented research & innovation in the European Union. A problem-solving approach to fuel innovation-led growth, European Commission, 2018, https://www.horizon-europe.gouv.fr/sites/default/files/2022-11/mazzucato-report-2018-pdf-7474.pdf.

12.

Strengthening South-South cooperation in STI for climate and the environment, focusing on developing technological, social, and policy solutions tailored to the current ecological, cultural, and economic conditions of Global South countries. This cooperation should seek to prioritize the subjects of knowledge co-production, horizontal exchange of experiences, acknowledgment of local knowledge, and joint implementation of sustainable technologies. This document recommends progressing along two fronts, namely through creating new platforms and strengthening existing ones. In the first one, the establishment of a South-South Network for Territorialized Climate Science is recommended in this brief, aimed at fostering technical and scientific cooperation among developing countries that share similar and complementary socio-ecological traits. The network should prioritize agendas such as agroecological innovation, adapted social technologies, resilient food systems, and participatory climate change monitoring. It should also engage with universities, research institutes, and grassroots organizations, in addition to integrating with both regional and multilateral platforms. The network will feature a multilateral program designed specifically for the exchange of scientific knowledge, traditional knowledge, and social technologies among Global South countries impacted by desertification. Furthermore, there is a need to strengthen existing regional scientific networks, including the Intergovernmental Scientific and Technical Panel for the Amazon, the Amazon Innovation and Technology Diffusion Network, and the new BRICS climate research and applied technology platform⁶⁸. Finally, it is also imperative to devise multilateral funding and exchange programs, expand participation in established mechanisms like the New Development Bank, and reinforce coordination with existing bodies such as ACTO and BRICS itself.

13.

Increasing funding allocation for research collaboration between the Global North and the Global South on environmental and climate issues.

Although there are successful cases of North-South and South-North-South triangular cooperation – defined by more horizontal relationships -, investments in such initiatives remain significantly lower than those allocated to partnerships among Global North institutions. There is a pressing need to restore balance by strengthening equitable collaboration models that duly acknowledge the scientific leadership of the Global South and support the co-production of knowledge on equal footing.

^{68.} BRICS. BRICS approves first recommendation on climate finance ahead of COP30. BRICS Brasil, 2025, https://brics.br/pt-br/noticias/brics-aprova-primeira-recomendacao-sobre-financiamento-climatico-rumo-a-cop30

14.

Strengthening regional cooperation efforts, such as those outlined in the Belém Declaration, to ensure locally appropriate solutions and to develop and implement a unified STI strategy aimed at strengthening socio-biodiversity value chains across the Pan-Amazon region. Regional scientific panels, such as the proposed Intergovernmental Scientific and Technical Panel for the Amazon, and networks like the Association of Amazonian Universities (UNAMAZ), should be representative and fully implemented to develop evidence-based STI recommendations that adequately reflect the specific environmental, social, and economic contexts of each region. Universities and research institutions should bolster South-South cooperation initiatives and establish joint STI capacity-building programs with institutions in both developed and developing countries. Furthermore, governments should allocate stable funding to such panels and integrate their findings into national STI and environmental policies to ensure that scientific, traditional, and local knowledge informs decisionmaking. The role of the corporate and industrial sectors is also critical, and efforts should be made to attract companies working in the production, marketing and sales of local biodiversity products, as well as to strengthen the broader corporate ecosystem.

RECOMMENDATIONS - BRAZILIAN NATIONAL LEVEL⁶⁹:

15.

Fostering a regulatory framework for the integration of Scientific, Traditional, and Local Knowledge into the National STI system⁷⁰. This recommendation should encompass multiple ministries (initially the Ministry of Science, Technology and Innovation - MCTI; Ministry of the Environment - MMA; Ministry of Agrarian Development - MDA; Ministry of Indigenous Peoples - MPI; and Ministry of Foreign Affairs - MRE), the

^{69.} The importance of the Purple Book - "Science, Technology and Innovation for a Just, Sustainable, and Developed Brazil: Contributions to an STI Strategy" -, cannot be overstated, as it is the outcome of the preparatory process for the 5th National STI Conference, held in 2024. It serves both to help devise new recommendations and to build upon those already presented in this brief. Furthermore, it should be noted that the abovementioned recommendations stem from research studies and discussions carried out within the scope of this Policy Brief that aim to engage more directly with the content discussed in the text above. The Purple Book is available at: https://ad5cncti.cgee.org.br/documents/165901/355373/livro-violeta_5CNCTI.pdf

^{70.} The regulatory framework will be informed by the Legal Framework for STI (Constitutional Amendment No. 85/2015; Law No. 13.243/2016; Decree No. 9.283/2018), the Law on Access to Genetic Heritage and Fair Benefit Sharing (Law No. 13.123/2015), and the Solidarity Economy Law (Law No. 15.068/2024), thereby reinforcing interministerial coordination among the MCTI, MMA, and MDA ministries. See the publication "Cua'gu and Innovation", available at: wttventures.net/publicacoes/

scientific community (such as ABC and SBPC), funding agencies (such as CNPq, CAPES, and state-level FAPs), and representative organizations of Indigenous Peoples, traditional and local peoples and communities, in addition to smallholder farmers, with the objective of advancing the official recognition of traditional and local knowledge as an integral and legitimate part of Brazil's STI system. The framework should provide for ethical and benefit-sharing protocols for research studies that incorporate traditional and local knowledge, ensuring such knowledge is duly recognized and acknowledged in public policies on climate change and biodiversity. This initiative is a direct response to the commitments Brazil took on under the Kunming-Montreal Global Biodiversity Framework and the Climate COPs, placing the country at the forefront of the implementation of a truly plural and inclusive National Innovation System capable of providing more effective responses to current socio-environmental challenges.

16.

Establishing a national policy for the governance of climate and territory data based on social participation, recognition of citizen-generated data, socio-territorial impact indicators, and the principles of digital commons. This policy should provide national guidelines for the ethical gathering, storage, sharing, and use of climate and territorial data, while recognizing the latter as digital commons that are critical for a just ecological transition. Furthermore, it should include incentives for the co-production of climate knowledge, focusing on the promotion of open data, plural methodologies and interoperability, and consequently helping to create a national platform. This platform should be developed with the active participation of civil society organizations, Indigenous Peoples and traditional and local communities, universities and research centers, and corporate stakeholders, aimed at ensuring shared governance, interoperability, transparency, and respect for collective rights, as well as incorporating citizen-generated data. This brief recommends the creation of open-access public repositories to acknowledge the importance of local knowledge, prevent digital extractivism, and ensure the generation of social and environmental benefits for all applicable territories, with special attention to the safeguarding of sensitive data within contexts of socioenvironmental vulnerability.

Adding data sovereignty as a pillar of a just ecological and digital transition.

The concept of data sovereignty should be embedded as a core component of the National Science, Technology and Innovation System (STI) and interface with the objectives of a just ecological transition. The recommendation herein is for new regulatory frameworks to be devised to guarantee public, community-based, and transparent control over environmental and territorial data, while endeavoring to align this agenda with the concepts of the self-determination of peoples and democratization of access to information within the scope of climate justice. This additionally contributes to strengthening national capacities in climate innovation, adaptation, and monitoring.

Establishing Integrated Regional Centers of Innovation for Just Transitions

- territorialized innovation spaces that merge academic, technical, and traditional knowledge systems, especially in biomes such as the Amazon, Cerrado, and Caatinga. These centers can be the outcome of institutional innovation carried out by reference institutions already present in priority regions. Moreover, they can contribute to fostering new institutional arrangements that build upon territorialized spaces and rationales that acknowledge the importance of co-production of knowledge, integration of academic, technical, and traditional knowledge systems, and testing of solutions that are tailored to local conditions, thereby leading to convergence among STI, climate justice, and territorial sovereignty policies.

Promoting discussions on technology transfer by leveraging the National Action Plan to Combat Desertification and Mitigate the Effects of Drought

(PAB). Such efforts can be run by the National Commission to Combat Desertification (Ministry of the Environment - MMA), in conjunction with the Ministry of Science, Technology and Innovation (MCTI), focused on the National Institute for the Semi-Arid (Insa), Embrapa, local universities, civil society organizations, and state governments, and aimed at bridging the gap between scientific knowledge and hands-on application. The initiative can help map out current technologies and knowledge applicable to impacted regions, create regional technology transfer hubs and social technology incubators featuring the active engagement of local communities in the development and implementation of solutions, and establish a dedicated fund to finance projects compliant with PAB guidelines. In addition, systematic processes should be developed for documenting and disseminating traditional knowledge and social technologies already used by local communities in combating desertification, thereby ensuring appropriate intellectual property protection as well as implementing monitoring indicators to assess the actual impact of transferred

technologies on territorial resilience. The importance of mainstreaming food security promotion cannot be understated, and it should be integrated into institutional spaces designed for social participation, such as the National Commission on Agroecology and Organic Production (CNAPO), the National Council for Sustainable Rural Development (CONDRAF), and the National Council for Food Security and Nutrition (CONSEA).

20.

Promoting the establishment of a national mechanism for the convergence of the Rio Conventions to foster integrated approaches across the climate, biodiversity, and desertification agendas. This mechanism should be led by an interministerial committee comprising the Ministry of the Environment (MMA), the Ministry of Science, Technology and Innovation (MCTI), the Ministry of Foreign Affairs (MRE), and the Civil House, with official participation of representatives from civil society, Indigenous Peoples, traditional communities and smallholder farmers, academia, and the private sector. Furthermore, the mechanism should strive to put in place a coordinated strategy for the effective implementation of all three conventions across the Brazilian territory by recognizing existing synergies among the Paris Agreement, the Kunming-Montreal Global Biodiversity Framework, and the Brazilian Action Plan to Combat Desertification. It should additionally devise planning mechanisms to prevent duplication of efforts and maximize co-benefits across mitigation, adaptation, biodiversity conservation, and desertification measures. This integration should primarily seek to strengthen social participation and, to this end, provide logistical and financial support to enable the participation of civil society organizations in forums related to the Rio Conventions, thereby helping to materialize the democratization of foreign⁷¹ and scientific⁷² policy.

^{71.} Closs, Marília. Democratização da política externa brasileira, participação social e clima: o que isso tem a ver? *Diálogos Soberania e Clima*, v. 4, n. 1, 2025, https://soberaniaeclima.org.br/wp-content/uploads/2025/04/Dialogos-Soberania-e-Clima-Especial-Marco-2025-Portugues-04-64-75.pdf.

^{72.} Invernizzi, Noela. Minipúblicos e movimentos ativistas na democratização da ciência e da tecnologia. *Análise Social*, 247, LVIII(2.º), 2023, https://revistas.rcaap.pt/analisesocial/article/download/33536/23431/146539.

