

## Accelerating Green and Just Transition in the Global South: A Country-led, SDG-aligned, and People-centered Framework for Action

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The global transition to a low-carbon economy presents both unprecedented opportunities and significant challenges, particularly for countries in the Global South. While existing just transition (JT) frameworks provide important guidance, they often reflect priorities and pathways from the perspective of developed economies or the interests of donor countries. Against this background, comparative research of existing JT practices and text analysis of 66 developing countries' updated Nationally Determined Contributions (NDCs) and Biennial Transparency Reports (BTRs) were conducted; findings indicate that existing JT frameworks differ greatly in scope, goals, and implementation methods between the Global North and Global South. This study then suggests a paradigm shift for the Global South's JT, which requires comprehensive, inclusive, and sustainable development alongside climate goals, with green economic opportunities as the main pathway forward, consistent with the Paris Agreement and the Sustainable Development Goals (SDGs). An evaluation framework is proposed and applied using public data, which offers a comprehensive yet flexible structure for countries

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to assess progress, identify gaps, and design targeted interventions across the three pillars of *Goals, Pathways, and Readiness and Capacity*. It enables countries to integrate JT into NDCs actions and make changes possible.

**Keywords:** Just transition; Global South; sustainable development; SDGs; climate finance; industrial policy; country-led transition.

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## 1. Introduction

The global transition to a low-carbon economy presents both unprecedented opportunities and significant challenges, particularly for countries in the Global South. While existing just transition (JT) frameworks provide important guidance, they often reflect priorities and pathways from the perspective of developed economies or the interests of donor countries. As more actors adopt this language, meanings proliferate. “JT” also risks being applied so broadly — encompassing workforce, competitiveness, territorial integrity, green reindustrialization, North–South equity — that it loses precision as a guide for action and for tracking progress. The concept originated within labor movements and trade unions, emerging as a critical safeguard to ensure that climate policy did not unjustly penalize workers and communities dependent on high-carbon industries (ILO, 2024). Since then, it has moved from labor movement debates over worker protection into the center of contemporary climate governance, but its meaning continues to vary across political and developmental contexts (Gather et al., 2025). In developed economies, the term is often used to describe how workers, regions, and firms can be protected during fossil fuel phasedowns. In the Global South, however, the concept must also speak to industrialization, infrastructure deficits, energy poverty, informality, and limited historical responsibility for emissions. These divergent starting points make context-sensitive interpretations essential.

The urgency of rethinking transition for the Global South stems from three intersecting realities. First, these countries face disproportionate climate impacts — from droughts in sub-Saharan Africa to cyclones in the Caribbean — despite having contributed the least to historical emissions. Second, they are expected to decarbonize while still struggling with energy poverty, informal labor markets, and infrastructure deficits that developed economies had already solved before their own transitions began. Third, the gap between climate finance needs and actual commitments remains staggering: developing countries (excluding China) require an estimated 2.3 trillion US dollars annually until 2030 to meet their Nationally Determined Contributions (NDCs) (Bhattacharya et al., 2024), yet the COP29 agreement pledged only 300 billion US dollars per year by 2035. Without a context-sensitive framework

that treats development and decarbonization as co-equal objectives, JT risks becoming either a Northern concept ill-fitted to Southern realities or an empty label attached to business-as-usual investment.

Despite growing international commitment to JT, critical gaps remain. Most existing frameworks originate in developed economies, where the primary concern is managing the decline in carbon-intensive sectors. For the Global South, however, JT must address fundamentally different questions: how to industrialize, expand energy access, and reduce poverty while simultaneously decarbonizing. The absence of a coherent, empirically grounded framework tailored to Southern contexts undermines policy coordination, international finance allocation, and progress tracking. This study therefore asks: How do major JT frameworks define the concept? And how can countries systematically assess and advance their JT performance?

Guided by the principles of country-led autonomy, alignment with the SDGs, and a people-centered orientation, this study develops an analytical framework that operationalizes JT from a Global South perspective. Rather than treating these as separate add-ons, the framework embeds them into its three pillars: Goals (SDG-aligned), Pathways (country-led), and Readiness and Capacity (people-centered).

## 2. Literature Review

### 2.1. Existing organizational and regional JT frameworks

Several institutional frameworks now structure the global JT debate, especially those of the United Nations Framework Convention on Climate Change (UNFCCC), the European Union (EU), the G20, and a growing set of country-led approaches. Together they show both the maturation of the agenda and the remaining disagreement over its scope, financing, and implementation.

The Paris Agreement anchors JT in decent work and nationally defined development priorities, while subsequent UNFCCC work and the Silesia Declaration strengthened the emphasis on worker protection, social dialogue, and integration into NDCs and long-term strategies (EU, 2018; UNFCCC, 2015). Established at COP27 and advanced at COP28, the United Arab Emirates JT Work Programme (JTWP) seeks to translate those principles into continuing dialogue on energy, social protection, employment, and nationally defined development priorities. Its significance lies less in immediate funding than in its recognition that transition is an economy-wide governance challenge rather than a narrow labor-market issue (UNFCCC, 2025).

The EU's JT Mechanism represents the most financially substantial regional framework, mobilizing approximately €55–75 billion over 2021–2027 to support territories most affected by the transition to climate neutrality. The mechanism comprises three pillars: the JT Fund (€19.7 billion in grants), InvestEU's dedicated scheme, and the Public Sector Loan Facility combining EU grants with European

Investment Bank loans (EU, 2020). The EU framework targets specific coal and carbon-intensive regions within member states, requiring Territorial JT Plans before accessing funds. While innovative in its comprehensive support approach, the EU model has faced criticism for potentially prioritizing industrial interests over marginalized communities and for its narrow geographic focus on European regions rather than global implications of European consumption patterns and resource extraction from the Global South (Behuria, 2025; Hyldmo *et al.*, 2024).

The G20 Bali Leaders' Declaration commits to clean, sustainable, just, affordable and inclusive energy transitions, tying JTs to energy security, affordability and national circumstances, and helping frame Just Energy Transition Partnerships (G20, 2022). This lens is energy-centric, focused on orderly, financed, socially mindful shifts.

At the same time, disagreements over scope and implementation reveal that the concept remains politically contested. Developing countries, represented by the G77, advocate for detailed work plans and broader scope including adaptation and loss and damage, while developed countries such as Australia, Canada, and the United States argue for more gradual consensus-building before specific implementation measures (Kulcsar, 2025).

Endorsed in October 2024 at Foz do Iguaçu, Brazil, the G20's 10 voluntary principles represent an attempt to bridge Northern and Southern perspectives on JT. These principles emphasize long-term energy planning, decent work and quality jobs in accordance with nationally defined development priorities, social protection systems, intersectional perspectives on gender and vulnerable populations, respect for human rights and indigenous peoples' rights, and mechanisms for fair cost allocation with focus on mobilizing resources for developing countries.

Significantly, the G20 principles acknowledge technological neutrality and "different national circumstances, needs and priorities as well as different pathways and approaches" (G20, 2024). This flexibility represents recognition that one-size-fits-all approaches are inadequate for the diverse G20 membership spanning developed and developing economies. Brazil's 2024 G20 presidency particularly elevated Global South concerns, emphasizing country platforms and bottom-up transition planning.

No single country can represent the diversity of the Global South. Nevertheless, examining how large developing economies operationalize JT provides useful insights. For instance, China's framework emphasizes "green transition as a new engine for economic and social development" as the fundamental approach (Xi, 2025). It is also noteworthy that China has implemented comprehensive policies for coal sector transition, including specialized funds for workforce development, resource development, and industrial reform in resource-dependent cities (Hu, 2023), thereby embedding JT objectives within broader regional development and industrial policy agendas, and generating transferable policy experience and institutional capacity for implementing JT under climate governance imperatives.

Brazil similarly frames JT as a development-centered and equity-driven process that integrates climate action with poverty eradication, inequality reduction, and climate justice, while recognizing differentiated responsibilities and protecting vulnerable groups across socio-economic systems (Brazil Ministry of Science, Technology and Innovation, 2024). Its narrative — reinforced by President Luiz Inácio Lula da Silva’s international speeches — positions forests, especially the Amazon, as core to the solution through bioeconomy and job creation, and emphasizes national sovereignty, fair global rules, and the need for climate finance from developed countries, alongside a pragmatic stance on fossil fuels as part of development (Silva, 2023).

Tables 1 and 2 summarize the main political definitions and show how priorities shift across institutional contexts. The comparison reveals fundamental divergences between Northern and Southern approaches to JT.

Table 1. Comparison of JT frameworks.

| Framework        | Primary Goals                                                                        | Scope                                                                     | Key Priorities                                                                                                                                                                                                                                                                                                                                             |
|------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNFCCC JTWP      | Achieve Paris Agreement goals equitably                                              | All sectors, mitigation-centric with growing adaptation focus             | Workforce transitions, social protection, country-led pathways                                                                                                                                                                                                                                                                                             |
| EU JT Mechanism  | Climate neutrality by 2050, leaving no one behind                                    | Regional/territorial, focused on fossil fuel and carbon-intensive regions | Economic diversification, SME support, reskilling, clean energy deployment                                                                                                                                                                                                                                                                                 |
| G20 Principles   | Net-zero by mid-century with social justice and poverty eradication                  | Energy transitions primarily, with society-wide participation             | Technological neutrality, financing for developing countries, nationally defined priorities                                                                                                                                                                                                                                                                |
| China’s Approach | Balance environmental protection, economic growth, job creation, poverty alleviation | Economy-wide ecological civilization,                                     | Economy-wide green transformation, Engine for economic and social development, social welfare, green technology leadership, South-South cooperation                                                                                                                                                                                                        |
| Brazil           | Achieve low-GHG, climate-resilient development with social justice                   | Economy-wide (energy, land use, forests, food, labor)                     | Inequality reduction; poverty and hunger eradication; protection of vulnerable groups and workforce transition; forest conservation and bioeconomy (Amazon); climate justice and Differentiated Responsibilities and Respective Capabilities (CBDR); sovereign development pathway; climate finance and fair global governance; balanced fossil transition |

Table 2. Comparison of JT frameworks of Global North and Global South.

| Dimension           | Global North (EU, International Labour Organization (ILO), Organization for Economic Co-operation and Development (OECD)) | Global South (UNFCCC Parties, China, African Union, Association of Southeast Asian Nations (ASEAN)) |
|---------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Core question       | How do we protect workers and regions while phasing out fossil fuels fast?                                                | How do we grow, industrialize, and eradicate poverty while aligning with climate goals?             |
| Core Objective      | Protect workers and communities during decarbonization                                                                    | Achieve both development and decarbonization                                                        |
| Economic Context    | Post-industrial/service-dominant                                                                                          | Industrializing/structural transformation underway                                                  |
| Primary Concern     | Employment restructuring, social participation                                                                            | Energy access, poverty alleviation, economic upgrading                                              |
| Sectors of focus    | Coal, fossil power, heavy industry                                                                                        | Power, industry, agriculture, cities, informal sector, Micro, Small and Medium Enterprises (MSMEs)  |
| Scope of Transition | Mainly energy & heavy industry                                                                                            | Whole-economy, including agriculture & MSMEs                                                        |
| Policy Instruments  | Social safety nets, retraining programs                                                                                   | Industrial policy, investment mobilization, technology localization                                 |
| Time Horizon        | Near-term emissions reduction                                                                                             | Sequenced transition over decades                                                                   |
| Justice Framing     | Distributional justice (fairness among workers/regions)                                                                   | Developmental justice (fair access to opportunities and technology)                                 |

Global North actors often define JT as a social fairness issue within a predominantly decarbonized or post-industrial context. Global South actors interpret JT as a pathway to economic restructuring, energy access expansion, and poverty alleviation, while decarbonizing.

A major difference is temporal and developmental context. Northern frameworks address transitions within already-industrialized economies with established social safety nets. The EU's JT Mechanism, for instance, focuses on managing the decline in specific carbon-intensive regions while maintaining overall prosperity. Southern frameworks, as evidenced by China's and Brazil's principles, must balance transition with ongoing industrialization, poverty reduction, and economic growth. For many Global South countries, the question is not how to transition existing infrastructure but how to leapfrog to green development while addressing immediate development needs.

From the perspective of scope and integration, Northern frameworks tend toward sectoral approaches — particularly energy and heavy industry — with job transitions as the central concern. The EU mechanism, while comprehensive, primarily targets specific regional transitions and job placement. Southern frameworks adopt more holistic, economy-wide approaches integrating climate action



with broader development objectives. China's "ecological civilization" concept exemplifies this integrated approach, where JT must "strike a balance between multiple goals including environmental protection, economic growth, job creation, and poverty alleviation" (Xi, 2025). Similarly, Brazil's official definition states that "climate justice is an ally of the fight against hunger and poverty, the fight against racism, gender equality and the promotion of a more representative and inclusive global governance" (da Silva, 2023).

For the Global South, capturing emerging green value chain opportunities represents not merely transition but also development strategy. Countries, such as China, India, Indonesia, and Brazil are positioning themselves as renewable energy manufacturing hubs, critical mineral suppliers, and clean technology innovators. This developmental dimension is largely absent from Northern JT frameworks, which focus on managing job losses and economic risks, rather than capturing growth and boosting development.

Another critical difference lies in financing structures. Northern frameworks mobilize substantial domestic resources alongside private capital in mature financial markets, whereas Southern frameworks face severe financing constraints - a gap that international climate finance has so far failed to close.

These divergences — across temporal context, scope, developmental logic, and financing — underscore that JT is not a monolithic concept. What it means and requires depends fundamentally on who is defining it and from which structural position. The organizational and regional frameworks reviewed here thus offer competing rather than complementary visions.

## **2.2. Academic literature**

The academic literature on JT initially developed around labor adjustment and fossil fuel phase-out, then gradually expanded in scope, connecting climate, energy, environmental, and social justice. A conceptual review shows that the field now encompasses at least five strands: labor-oriented transition, integrated justice frameworks, socio-technical transition theory, governance strategy, and public perception (Wang and Lo, 2021). In parallel, the concept moved from union and policy discourse into international climate law, especially through the Paris Agreement's reference to a JT of the workforce and nationally defined development priorities (Johansson, 2023). These foundational works explain how the concept gained normative authority, but they also reveal that early JT debates were largely shaped by the experience of advanced economies and by sectors where formal employment relations are most visible.

More recent reviews also show that the policy field has expanded faster than the early academic canon. This observation is consistent with policy-oriented syntheses such as that of the Institute for Global Decarbonization Progress, which situate JT within a broader shift from environmental and energy justice toward climate justice. In this view, JT emphasizes a people-centered approach grounded

in both intergenerational and intragenerational equity, while linking decarbonization with development objectives such as employment, poverty reduction, and inclusive growth. It also notes that, in practice, national JT frameworks remain fragmented and context-specific, reinforcing the need for flexible and country-led approaches (Hu, 2023).

One study that reviewed 75 non-academic frameworks found that governments, development banks, Non-Governmental Organizations (NGOs), and financial actors frequently include themes that were underdeveloped in mainstream academic reviews, including decolonization, human rights, circular economy, waste and water management, and the needs of informal workers and Small and Medium-sized Enterprises (SMEs) in Latin America and Sub-Saharan Africa (Ullman and Kittner, 2024). Complementing this, recent policy-oriented work — such as by the World Resources Institute (WRI) — emphasizes that JT should be grounded in a set of core principles, including people-centered development, equity and inclusiveness, country ownership, systemic transformation, and international cooperation. These frameworks extend beyond labor adjustment to highlight the importance of aligning climate action with broader development objectives, ensuring that transitions generate new economic opportunities while protecting vulnerable groups (WRI, 2024).

A distinctive Global South critique has therefore emerged around the problem of *transfer*. Many JT frameworks travel outward from Northern political economies where welfare systems, state capacity, and infrastructure are comparatively strong, and where the main policy question is how to close or convert high-carbon industries fairly. By contrast, it is argued that transitions research in the Global South must confront Western epistemic dominance, informal institutions, power asymmetries, and the struggles of communities navigating inequality, precarity, and incomplete infrastructure (Ghosh et al., 2021). In this regard, the WRI analytical framework provides an important extension by explicitly linking JT to three operational dimensions: transition outcomes (climate and development goals), transition pathways (including green industrialization, job creation, and service access), and enabling conditions (such as finance, governance, and social protection) (Lu and Chen, 2025). This structure moves beyond normative principles and offers a more systematic approach to diagnosing transition progress in developing countries. It also reinforces the argument that JT must be simultaneously evaluated across economic transformation, social inclusion, and environmental integrity, rather than being treated as a single-policy domain.

In addition, North-South finance arrangements can depoliticize justice and subordinate it to investor priorities, while neglect of production, technology, and value-chain dependence can reproduce structural dependencies within a new green division of labor (Behuria, 2025). Research on extractivism also shows how JT narratives can be used to legitimize new forms of resource extraction and colonial power rather than transform them (Titifanue, 2025). Taken together, these studies suggest that JT in the Global South cannot be treated only as a domestic



distributional issue; it must also be analyzed through climate finance, technology transfer, policy space, and global climate justice.

The regional literature is now rich enough to allow identification of several distinct strands. In Latin America, scholarship often approaches JT through labor rights, informality, human rights law, and indigenous and community protections. It is argued that a Global South approach in Latin America must move beyond imported transition narratives and take the region's socio-economic conditions, vulnerable groups, and the legal role of the Inter-American human rights system (Giupponi, 2023). Similarly, it is shown that Argentina and Chile's NDCs represent an important step in embedding JT language into national legal commitments but also demonstrate how high labor informality complicates worker protection and makes a purely formal-sector approach inadequate (Pucheta *et al.*, 2021). A big coal-based power system, strong union history, and international Just Energy Transition Partnership (JETP) have made South Africa a major reference point. It is found that South African research increasingly combines social justice with restorative justice and emphasizes health burdens, lived experience, and the need for more tailored and inclusive governance (Patrick *et al.*, 2025).

In South and Southeast Asia, the literature highlights different but related tensions. A study showed that Indian coal unions see social dialogue and local economic diversification as central to any viable JT, while also revealing how unevenly the concept has diffused among labor actors in India (Nangang *et al.*, 2024). The analysis on Indonesia's JETP offers a more critical warning that in high-profile North-South finance arrangements, justice can become depoliticized and subordinated to investor priorities, turning JT into a rhetorical label for an energy investment package rather than a redistributive project shaped by affected communities (Sud, 2025). These studies suggest that Global South JT debates are not only about whether transition should happen, but also about whose knowledge, labor, land, and institutions count in determining its terms.

A more recent body of comparative work is beginning to move the discussion from conceptual debate toward empirical synthesis. One study combined a realist review and qualitative comparative analysis and found that robust funding and strategic planning are universally necessary conditions for JTs in developing countries. The study also showed that JT outcomes in the Global South are highly context-dependent, with different combinations of finance, institutional capacity, governance, and program design leading to different transition pathways (Gather *et al.*, 2025). The insight helps explain why so many country cases exhibit a gap between policy rhetoric and implementation. The literature increasingly shows that participation, rights recognition, and local legitimacy remain essential normative goals, but they do not substitute for concrete fiscal mechanisms, credible transition planning, and institutions capable of coordinating energy, labor, industrial, and social policy.

Beyond the conceptual and geographical debates reviewed above, recent scholarship has extended JT analysis into three adjacent domains that are

particularly salient for the Global South. The first is climate finance, where studies show that current flows are not only insufficient but also poorly-structured — heavy on debt-based instruments, burdensome in access procedures, and often tied to policy conditionalities that constrain national ownership (Behuria, 2025). The second is industrial policy and green value chains, with a growing recognition that a truly JT must enable developing countries to move beyond raw material export and capture higher value in renewable energy, battery, and electric vehicle production. The third is governance and participation: inclusive social dialogue, stakeholder engagement, and monitoring systems are increasingly identified as necessary conditions for transition legitimacy and durability (Gather et al., 2025). These themes, while not always central to earlier JT frameworks, are essential for operationalizing the concept in the Global South.

Despite a growing and diverse body of research, the current literature still contains several important gaps. The first is geographical: current studies are still concentrated in selected developing countries, especially coal economies, while many lower-income countries, small island states, and non-coal transitions receive little attention. The second is sectoral: much of the literature focuses on coal and electricity, with far fewer studies on transport, agriculture, buildings, critical minerals, cities, and the informal service economy. The third is methodological: the field still contains far more conceptual argument and case-specific diagnosis than systematic, comparable evaluation of outcomes over time. A related gap concerns the consideration around justice itself. Distributional issues are often better specified than land rights, indigenous sovereignty, gendered impacts, and colonial or extractive power relations. Yet these questions are precisely what many Global South scholars identify as central to whether a transition is genuinely just rather than merely lower carbon. Therefore, this underscores the need for comprehensive frameworks capable of integrating development goals, productive transformation, affordability, rights, and international equity while remaining usable for country-level diagnosis and policy design.

### 3. Data and Methods

#### 3.1. Research method

This study integrates qualitative comparative analysis, structured literature review, and large-scale policy text analysis to examine how JT is conceptualized and operationalized across different contexts. The methodological approach is designed to address two core research questions: (1) how major JT frameworks define the concept, and (2) what type of evaluation framework can effectively support implementation in the Global South. Given the normative and context-dependent nature of JT, the study combines interpretive and empirical strategies to capture both conceptual variation and policy practice.

A systematic and structured literature review is first conducted to identify and synthesize major international JT frameworks. These include frameworks developed by multilateral institutions, organizations or platforms such as the ILO, the United Nations (UN), the EU and G20, as well as influential academic and policy contributions. The review focuses on extracting key dimensions of JT definitions, including scope, primary objectives, and implementation mechanisms.

An initial pool of 134 Global South countries (G77 members) was screened for the availability of both an updated NDC (post-2020) and a Biennial Transparency Report (BTR) (post-2024). The 66 countries meeting both criteria constitute the final sample. They include 22 African, 22 Asian, 20 Latin American and Caribbean, and 2 Oceanian countries. Among them, 11 are least developed countries (LDCs) and 11 are small island developing states (SIDS); two countries (Guinea-Bissau, Solomon Islands) belong to both categories. This composition ensures meaningful coverage of the most vulnerable and capacity-constrained contexts within the Global South.

NDCs are analyzed from three dimensions: policy instruments (domestic policy tools, international cooperation agendas), transition objectives (economic and social structural transformation, climate justice and resilience), and underlying paradigms (development-oriented paradigm, compensation-oriented paradigm).

A framework is then developed iteratively to categorize dimensions and indicators in existing frameworks, enabling a comparative assessment of how JT is framed across predominantly Global North-oriented approaches versus emerging Global South perspectives. The framework is then further structured around three core pillars (*Goals, Pathways, and Readiness and Capacity*) and further operationalized through eight guiding principles that capture key dimensions of JT in developing country contexts (Ullman and Kittner, 2024). These principles are then translated into a set of representative indicators under each pillar, enabling systematic assessment.

Finally, the proposed framework is tested through an empirical validation exercise using publicly available datasets, including data drawn from the 66 analyzed countries' NDCs and BTRs to assess feasibility, internal consistency, and policy relevance, and evaluate general trends of the transition in the Global South under the proposed framework (Fig. 1).

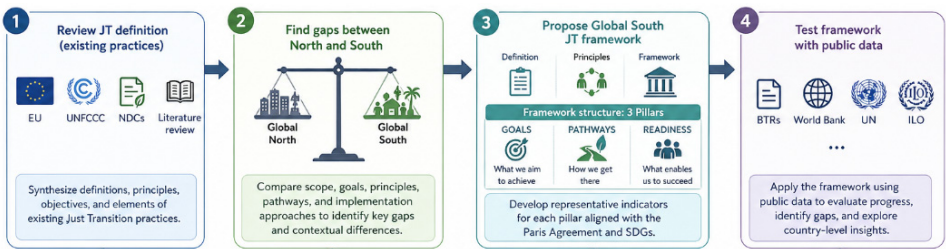


Fig. 1. Research steps.

### 3.2. Limitations

Several limitations should be acknowledged. First, the availability and quality of NDCs and BTRs vary significantly across countries, which may affect the consistency of comparative analysis. Second, while the indicator framework is designed to be comprehensive, data gaps and differences in statistical capacity — particularly in lower-income countries — may constrain full implementation. Third, the selection of indicators, though grounded in established international datasets, inevitably involves normative judgment regarding the relative importance of different JT dimensions. Finally, the framework emphasizes cross-country comparability, which may not fully capture context-specific institutional and political dynamics shaping JT pathways. Despite these limitations, the study provides a robust and scalable approach for integrating JT into climate policy analysis, particularly in the Global South.

## 4. Evaluating Progress Toward a Green and JT

### 4.1. Overall framework structure

From a Global South perspective, JT represents a development pathway that simultaneously achieves climate objectives and sustainable development goals through green economic transformation, ensuring that the benefits and burdens of decarbonization are equitably distributed both within and between nations. This conceptualization highlights several defining features that distinguish Southern perspectives.

First, it is *development-centric*. A JT is not merely about managing the social costs of decarbonization but about leveraging climate action as a catalyst for comprehensive development. It encompasses poverty eradication, job creation, industrialization, infrastructure development, and human capital formation.

Second, it reflects *dual and co-equal objectives*. Unlike frameworks that prioritize climate goals with social considerations, the Southern perspective treats climate action and sustainable development as co-equal, mutually reinforcing objectives. Progress on one dimension without the other represents an incomplete transition.

Third, it emphasizes *green economic opportunity*. Rather than merely compensating for losses in declining sectors, it is fundamental to set the ground for an alternative development pathway that not only is climate-resilient but also captures emerging opportunities in green value chains — renewable energy manufacturing, electric vehicles, battery production, critical minerals, sustainable agriculture, and circular economy.

Fourth, it underscores the importance of national *autonomy*. Southern countries must have agency to define their own transition pathways based on national circumstances, development stages, resource endowments, and priorities rather than having transition parameters defined by international actors.

Finally, it incorporates *North–South equity*. A JT encompasses not only domestic equity (between regions, sectors, and communities) but also international equity. This includes recognition of historical emissions responsibility, technology transfer, and adequate climate finance flowing from developed to developing countries as an obligation rather than charity.

To operationalize the Global South JT definition and principles, we propose a comprehensive evaluation framework structured around three pillars: Goals, Pathways, Readiness and Capacity. This framework enables systematic assessment of country progress while maintaining flexibility for national contexts and priorities (Fig. 2).

The first pillar, *JT Goals*, focuses on measuring the gap toward the primary climate and development objectives of JT, which is achieving Paris Agreement targets (climate goals) and advancing Sustainable Development Goals (social and economic goals). This pillar assesses both where a country is and where it needs to go.

The second pillar, *JT Pathways*, tracks and monitors the means and strategies by which countries are pursuing transition, focusing on highlighted approaches to capture green economic opportunities in global value chains, ensuring accessibility of green services, generating quality green employment, attracting green Foreign Direct Investment (FDI), and maintaining environmental integrity. This pillar assesses how a country is transitioning.

The third pillar, *JT Readiness and Capacity*, evaluates the fundamental conditions and capabilities required to safeguard equitable and inclusive transition, including social safety nets, international financing mechanisms, skills and training



Fig. 2. Pillars and dimensions of the Global South JT framework.



systems, and research and development capacity. This pillar assesses whether a country has the enabling conditions for a successful transition.

This three-pillar structure reflects the insight that successful JT requires clarity on destinations (*Goals*), effective strategies for getting there (*Pathways*), and supportive infrastructure and capabilities (*Readiness and Capacity*). Countries may excel in one pillar while facing challenges in others, allowing for targeted policy interventions.

The analytical value of this structure is that it makes sequencing explicit. Countries do not transition by outcomes alone; they transition through a combination of policy choices, institutional capabilities, and political bargains that unfold over time. A country may, for example, make visible progress on renewable deployment while still lacking the social protection, fiscal space, or industrial depth required to sustain the transition. Another may have strong readiness conditions but insufficient strategic focus on green sectors capable of generating jobs and export earnings. By separating into *Goals*, *Pathways*, and *Readiness and Capacity*, the framework allows policymakers to diagnose those differences rather than treating all underperformance as the same problem.

The framework is also designed to be adaptable rather than mechanically standardized. Not every country will weigh every dimension equally, and some indicators will be more useful in resource-rich economies, fossil fuel importers, small island states, or large manufacturing systems. What matters is that the framework preserves common logic: countries should assess where they want to go, how they intend to get there, and whether they possess the enabling conditions to do so fairly. Used in this way, the framework can support national planning, peer learning across the Global South, and more credible dialogue with international partners about what kinds of finance, technology, and policy support are needed.

In practical use, countries can apply the framework in three stages. The first is diagnostic: establishing a baseline and identifying the most binding gaps across the three pillars. The second is strategic: translating those findings into sectoral and territorial priorities, policy packages, and financing needs. The third is iterative: using the framework repeatedly to test whether implementation is changing outcomes and whether new bottlenecks are emerging. This staged approach helps governments turn a broad concept into a decision-making tool that is usable in planning ministries, line agencies, state-owned utilities, development banks, and subnational administrations. Building on this framework and as illustrated in Table 3, we developed a set of indicators that operationalize the conceptual framework into measurable criteria for assessing countries across the three pillars.

## 4.2. JT goals

The Goals pillar encompasses two interrelated dimensions: climate goals and socio-economic goals. Both are essential and neither should be privileged over the other in evaluating JT progress.



Table 3. Indicators' overview.

| Pillars                | Dimension                                     | Key Indicators                                                                                                                                                                                                               |
|------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Goals                  | Progress toward Climate Goals                 | Greenhouse gas (GHG) emissions, renewable energy, coal phase-down, and forests and land use                                                                                                                                  |
|                        | Sectoral Decarbonization Progress             | Renewable share in final energy consumption, energy intensity, and forest coverage and natural carbon sinks                                                                                                                  |
| Pathways               | Social and Economic Goals                     | GDP per capita, poverty rates, Human Development Index (HDI), unemployment rate, Gini index, and multifactor productivity (MFP)                                                                                              |
|                        | New Economy Opportunities                     | Renewable energy manufacturing capacity, electric vehicle (EV) and battery value chains, critical minerals and green materials, green technology research and innovation, circular economy development, and energy intensity |
|                        | Green Services Access and Affordability       | Clean electricity access and affordability, sustainable mobility, green buildings and housing, and circular and sustainable products                                                                                         |
|                        | Green Jobs Creation                           | Direct green jobs, job quality, labor transitions from declining sectors, youth and women's participation,                                                                                                                   |
|                        | Environmental Integrity                       | Air quality, water quality and availability, biodiversity and ecosystem health, and waste management and circular economy performance                                                                                        |
| Readiness and Capacity | Social Security and Safety Net                | Unemployment insurance and active labor market policies, skills development and reskilling systems, social assistance for vulnerable populations, and pension systems and retirement security                                |
|                        | Economic Resilience                           | Potential national income gains from avoided climate damages, and potential national income losses from climate risks                                                                                                        |
|                        | International JT and Financing Mechanisms     | Climate finance flows and sources, and access and conditionality                                                                                                                                                             |
|                        | Research, Development and Innovation Capacity | Research and development (R&D) investment, patent and innovation outputs, technology transfer and adaptation, and higher education and research institutions                                                                 |
|                        | Governance and Institutional Capacity         | Integrated climate governance, stakeholder engagement mechanisms, monitoring, reporting, and verification (MRV) systems, and policy and regulatory frameworks                                                                |

Source: Developed by the authors.

4.2.1. Progress towards climate goals

Climate goals assessment evaluates a country's progress toward its NDCs commitments and broader Paris Agreement objectives. It encompasses several key dimensions.

First, *greenhouse gas (GHG) emissions reduction* is measured by progress against NDCs targets and emissions intensity (per capita and per unit GDP); particularly relevant for the Global South as it enables balancing emissions mitigation with continued economic growth.

Second, *renewable energy deployment* is assessed through renewable share in the energy mix, installed capacity, and energy intensity; critical for leapfrogging fossil-based systems, given strong solar and wind resource endowments in many developing countries.

Third, *coal phase-down* is evaluated through trends in coal consumption, power plant retirements and additions, and existence of JT plans; highly sensitive in the Global South due to ongoing reliance on coal for energy access and associated socio-economic impacts.

Fourth, *forests and land use* are evaluated through forest cover change and reforestation efforts, especially important for forest-rich developing countries where carbon sinks play a central role in net-zero pathways.

Based on a systematic analysis of 66 developing countries that provided detailed climate goal narratives, we found that 78.8% of countries think they are on track toward climate goals, while 15.2% view themselves as off track, 6% remain uncertain, based on assessment of progress toward their NDCs commitments and the long-term objectives of the Paris Agreement (Table 4).

Countries that are classified as “on track” generally attribute their success to several key drivers: Significant Carbon Sinks, Renewable Energy Transitions or Policy Alignment. Many countries, particularly those with high forest coverage, such as Guyana, Gabon, and Bhutan, maintain their status as carbon-neutral or net-negative emitters.

Some countries’ progress has been driven by the rapid scaling of solar, wind, and hydro power. For example, Kenya and South Africa are noted for accelerating their transition to low-carbon electricity. Countries such as Mexico and China demonstrate progress because their current emissions trends or energy shifts align with their updated NDCs targets.

Table 4. Analysis on progress towards climate goals.

| Status       | Count | Percentage | Scientific & Trend Definition                                                                            |
|--------------|-------|------------|----------------------------------------------------------------------------------------------------------|
| On Track     | 52    | 78.8%      | Emissions pathways align with NDCs targets; significant absolute or intensity reductions achieved.       |
| Out of Track | 10    | 15.2%      | Emissions show a significant upward trend relative to base years; policy interventions are insufficient. |
| Uncertain    | 4     | 6.0%       | Projections indicate potential emission rebounds or data volatility prevents a definitive trend.         |

*Note:* Analysis based on BTRs.

Countries struggling to meet their goals typically face the following challenges. In some countries, such as Zambia and Zimbabwe, emissions have surged (up to 33% or more) from baseline levels due to development needs, urbanization, or changes in land use, making reaching 2030 targets “highly challenging”. Other countries, such as Nigeria, may have achieved short-term reductions but face “uncertainty” because their future projections under “with measures” scenarios still show a significant upward trajectory.

Penetration of clean technology (e.g. EVs or advanced industrial systems) remains low in many developing regions, creating a gap between ambition and implementation. Implementing large-scale mitigation is often contingent on receiving technical aid and foreign investment to bridge the domestic implementation gap.

The analysis strongly indicates that international finance and technology transfer are vital for Global South countries. Nearly 50% of the countries identified as “Out of Track” or “Uncertain” explicitly mentioned the need for “significantly scaled-up international financial support”.

We observe a clear expansion of ambition and scope based on the quantitative analysis of the 66 countries that provided detailed data on the types of GHGs and pollutants covered in their climate goals. As shown in Table 5, most countries are moving beyond simple carbon dioxide (CO<sub>2</sub>) targets toward comprehensive multi-gas coverage. Of the 66 countries analyzed, 12 (18%) have integrated Short-Lived Climate Pollutants (SLCPs) — such as black carbon and ozone — into their national climate frameworks. This inclusion signals a strategic shift from broad global mitigation toward the prioritization of “Local Co-benefits”. By targeting these pollutants, these nations are simultaneously addressing urgent respiratory health crises and bolstering food security.

4.2.2. Sectoral decarbonization progress

Assessment of decarbonization depends not only on absolute emissions reductions but also on the reshaping of energy structures, technological accumulation, and ecological carrying capacity, namely the socio-economic goals. Accordingly, this

Table 5. Greenhouse gases coverage in NDCs.

| Gas Coverage                                                             | No. of Countries | Share |
|--------------------------------------------------------------------------|------------------|-------|
| All GHGs                                                                 | 25               | 37.9% |
| 4 Gases (CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, and HFCs) | 20               | 30.3% |
| 3 Gases (CO <sub>2</sub> , CH <sub>4</sub> , and N <sub>2</sub> O)       | 20               | 30.3% |
| CO <sub>2</sub>                                                          | 1                | 1.5%  |
| Total                                                                    | 66               | 100%  |

*Note:* Analysis based on countries’ NDCs, using latest submitted or updated versions.

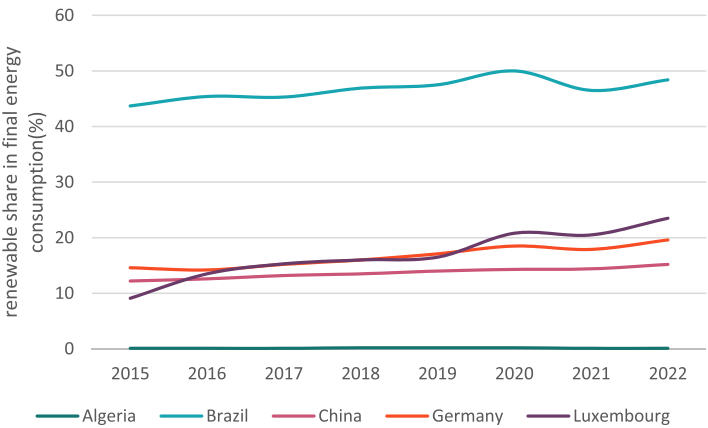
analysis adopts a set of core indicators that capture both the depth and distributional dimensions of the transition.

First, *renewable share in final energy consumption* serves as a key measure of transition depth. The integration of renewables into total final energy consumption is a critical measure of transition depth because it accounts for greening in heating and transport, which are historically harder to abate than electricity. Second, *renewable energy capacity*, measured both in total and on a per capita basis, reflects infrastructure development and distributional equity. While total installed capacity serves as a proxy for infrastructure readiness, the per capita distribution reveals a profound inequality in the energy domain.

As illustrated in Fig. 3, global progress has been characterized by significant polarization. Leaders such as Germany and Luxembourg have demonstrated consistent policy-driven growth. Meanwhile, major emerging economies such as China have acted as the global volume drivers. In contrast, fossil-dependent nations such as Algeria have remained stagnant, illustrating the structural “lock-in” effect in hydrocarbon-exporting economies.

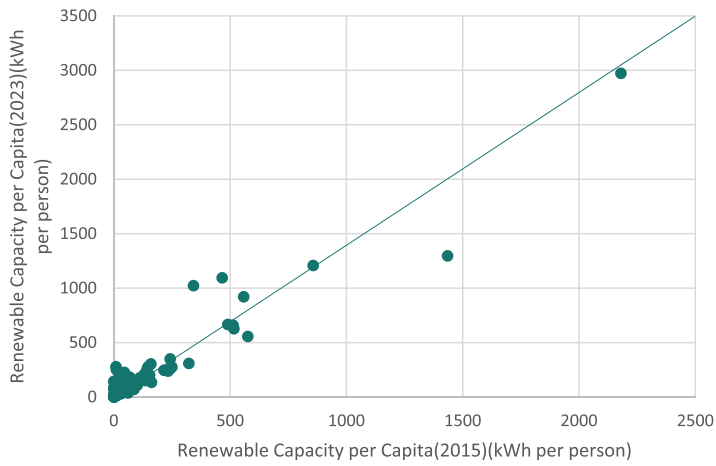
Figure 4 further illustrates that the majority of countries lie above the diagonal line, confirming a broad-based increase in renewable capacity per capita between 2015 and 2023. However, the wide vertical spread at higher capacity levels reveals persistent disparities: only a few countries have reached high per-capita levels, while most remain relatively low.

*Second, energy intensity* measures the efficiency with which an economy converts energy into wealth, a prerequisite for absolute decoupling. As shown in Fig. 5, significant improvements have been concentrated in high-income regions, where the EU and North America have seen steady declines in intensity levels. In contrast, we observe regression in developing countries where energy efficiency



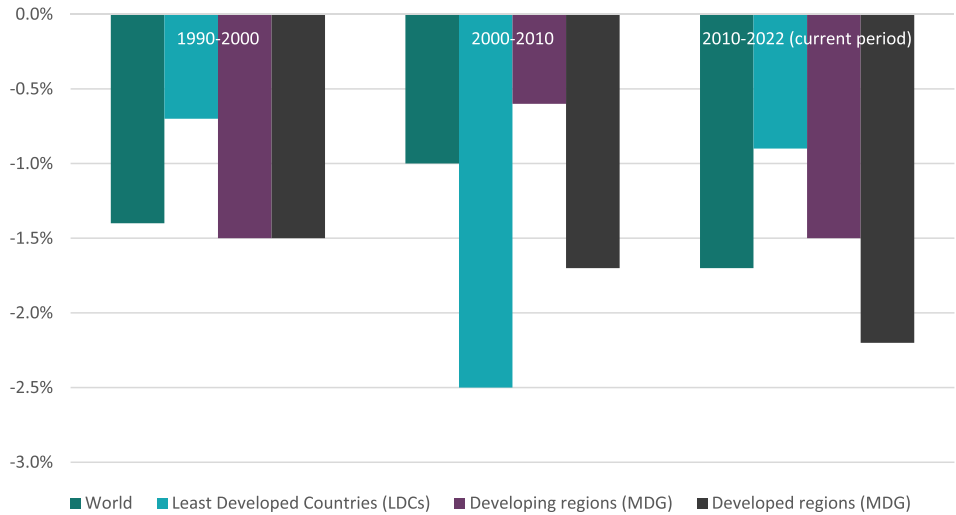
Data Source: World Energy Balances (2025).

Fig. 3. Renewable share in final energy consumption in selected countries.



Note: The diagonal line indicates no change; points above the line represent an increase from 2015 to 2023, while points below represent a decrease. Data Source: UN (2026).

Fig. 4. Renewable capacity per capita of G77 countries, 2015 vs. 2023.



Data Source: UN (2026).

Fig. 5. Energy intensity change since 1990 by groups.

improvement slowed down since 1990, likely due to the development of an energy-intensive economic structure and industrial inefficiency.

Finally, *forest coverage and natural carbon sinks* constitute a critical component of decarbonization pathways, particularly for balancing residual emissions and enhancing ecological resilience. Countries such as China and Costa Rica have

seen restorative growth owing to active national greening programs. However, regions under extreme livelihood pressure are losing forest area at alarming rates. Between 2015 and 2023, forest resources in countries such as Angola and Guyana were often traded for immediate economic survival or agricultural expansion.

#### 4.2.3. Social and economic goals

Social and economic goals assessment evaluates progress toward comprehensive sustainable development. Drawing on SDG indicators and development economics. The selected indicators capture both the enabling conditions and distributive outcomes of a JT.

First, *GDP per capita* serves as a proxy for overall economic development and the fiscal capacity to support green investment. In 2024, clean energy was a primary engine of this growth, accounting for 10% of China's total economy and driving a quarter of its entire GDP increase. However, the "polycrisis" — characterized by economic stagnation and conflict — has hindered transition in vulnerable zones. Afghanistan's GDP per capita fell significantly by 2023, severely limiting its capacity to transition away from traditional biomass toward cleaner energy sources.

Second, *poverty rates* reflect the inclusiveness of development pathways. There is a positive and significant association between green development and poverty reduction, particularly when mediated by industrial upgrading. Indonesia represents a major success, dropping its poverty rate from 21.6% in 2015 to 7.9% by 2022. In contrast, Middle Africa saw poverty increase in the same period, suggesting that energy gains are failing to reach the most marginalized groups.

Third, the *Human Development Index (HDI)* serves as a holistic benchmark for overall well-being. Leaders such as Iceland and Norway continue to set the global standard. Notable "catch-up" progress is observed in G77 nations such as the UAE. These improvements typically mirror a shift toward more diversified, higher-productivity energy systems.

Fourth, the *unemployment rate* captures labor market dynamics during structural transformation. Global labor markets are shifting from high-carbon to low-carbon sectors. By 2023, global clean energy jobs reached 34.8 million. While many regions faced an unemployment spike in 2020, the EU and Euro area have shown a strong structural recovery, with rates falling significantly by 2024. This recovery is increasingly driven by investments in green infrastructure and technology.

Fifth, the *Gini index* measures income inequality, a critical determinant of transition speed. High inequality nations such as Namibia and Brazil face a "distributed technology barrier" where the upfront cost of renewables such as solar panels remains out of reach for the poorest 40% of the population (World Bank Shared Prosperity framework).

Finally, *multifactor productivity (MFP)* reflects the efficiency of resource allocation and innovation, serving as an indicator of long-term growth potential.



The US has shown a spectacular “catch-up” trajectory since the 1990s. Conversely, Argentina has seen a productivity regression, with its TFP falling from its 1970s peak.

### 4.3. Pathways

The Pathways pillar evaluates how countries are pursuing transition — the specific strategies, investments, and mechanisms being deployed. This pillar is particularly crucial for distinguishing developmental JT from mere compensation-based approaches.

#### 4.3.1. *New economy opportunities*

This dimension evaluates whether countries are successfully capturing green economic opportunities in emerging global value chains. The rationale is that the most profound and sustainable JT occurs when countries can participate in — and benefit from — the growth sectors of the future economy rather than merely managing the decline of legacy sectors. Several key indicators are employed to assess this dimension.

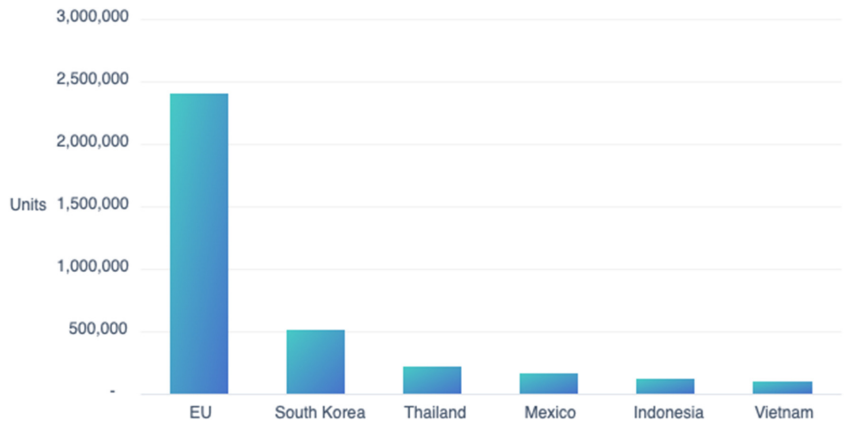
First, *renewable energy manufacturing capacity* captures the extent of domestic participation in the production of clean energy technologies, including solar panel production, wind turbine manufacturing, green hydrogen facilities, and battery production. As China remains the biggest hub for renewable manufacturing, second-tier specialized hubs rather than a broad-based global catch-up, e.g. Southeast Asian countries are quickly expanding their solar panel production, while Brazil is steadily growing its wind turbine production capacity.

Second, *electric vehicle (EV) and battery value chains* assess participation in downstream and upstream segments, including EV assembly, battery manufacturing, and charging infrastructure production. Countries such as Indonesia (nickel-rich) and Chile (lithium-rich) have opportunities to move beyond raw material export to value-added manufacturing. As shown in Fig. 6, several developing countries are quickly ramping up domestic production from almost zero in two to three years.

Third, *critical minerals and green materials* evaluate not only resource extraction but also processing, refining, and manufacturing. The Democratic Republic of Congo holds 70% of global cobalt reserves but captures minimal value.

Fourth, *green technology research and innovation* is measured through indicators such as research intensity, patent applications, and technology innovation. Chinese companies now account for 75% of global clean energy patents, up from 5% in 2000. This represents genuine technological leadership beyond manufacturing.

Fifth, *circular economy development* captures the extent of recycling infrastructure, remanufacturing capacity, and sustainable materials. The ILO estimates circular economy transitions could create 6 million net jobs globally.



Data Source: Federation of Thai Industries (2026), IEA (2025), Prodensa (2024), Vietnam Law Magazine (2025).

Fig. 6. Passenger EV production in selected countries (2024).

Finally, *energy intensity* serves as a proxy for both structural transformation and efficiency gains, reflecting the ability to decouple economic growth from energy consumption, thereby enhancing industrial competitiveness and energy security.

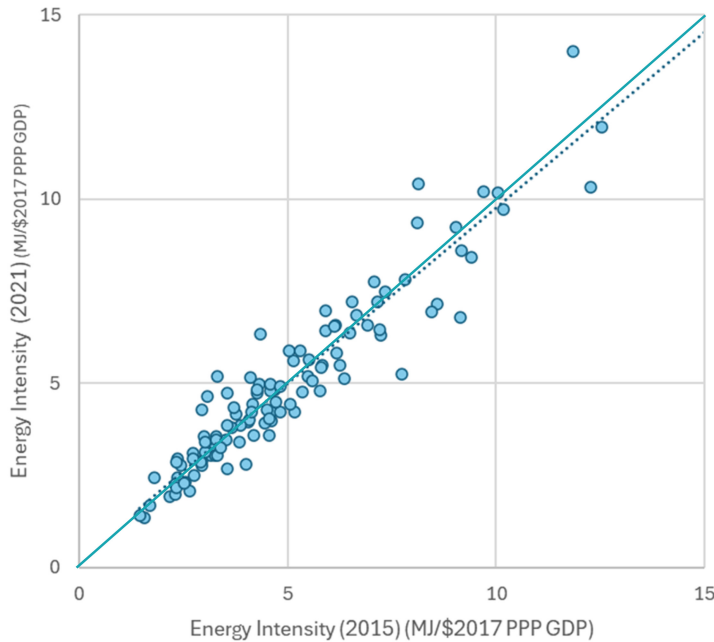
As illustrated in Fig. 7, the efficiency improvement progress across countries is uneven, as industrialization is underway in the majority of developing countries. Average energy intensity in most regions is flat, while improvement is observed in South and Central Asia, and increased energy intensity is observed in East Asia and the Pacific.

#### 4.3.2. Green services access and affordability

A critical but often overlooked pathway dimension is ensuring that green services are accessible and affordable for all segments of society. This is a core equity challenge because greener products and services are often more expensive than incumbent high-carbon alternatives, especially where markets are shallow and public subsidies are limited. To assess this dimension, several key indicators are considered.

First, *clean electricity access and affordability* evaluate both the extent and inclusiveness of energy transitions. Relevant metrics include the share of the population with access to electricity, the share of renewable energy in the electricity mix, electricity affordability relative to income levels, and time-of-use pricing and demand management to optimize renewable integration.

Second, *sustainable mobility* captures the availability, quality, and affordability of low-carbon transport options. Indicators include public transport accessibility, quality, and pricing, availability of affordable electric two-wheelers and vehicles, and non-motorized transport infrastructure (walking, cycling). For much of



*Note:* 113 countries from G77 countries are analyzed in this chart due to data availability. The diagonal solid line indicates no change; points above the line represent an increase from 2015 to 2021, while points below represent a decrease. *Data Source:* World Bank Group (2021).

Fig. 7. Energy intensity change in G77 countries from 2015 to 2021.

the Global South, sustainable mobility means improved public transport, not necessarily electric private vehicles.

Third, *green buildings and housing* assess the extent to which energy-efficient and climate-resilient housing is accessible to the broader population. This includes energy-efficient housing affordability, green building standards implementation, and retrofitting programs for existing housing stock. The residential sector accounts for significant energy consumption, particularly for heating/cooling.

Finally, *circular and sustainable products* evaluate the availability and affordability of low-carbon alternatives to conventional goods. This includes availability and pricing of sustainable alternatives to high-carbon goods, support for local sustainable production, and regulation of planned obsolescence to extend product lifespans.

#### 4.3.3. Green jobs creation

Job creation is perhaps the most politically salient pathway dimension. Based on International Renewable Energy Agency (IRENA) and ILO statistics, the renewable energy industry (covering solar photovoltaic, biofuel, heat pumps, amongst others) created 16.6 million jobs around the globe in 2024 (ILO, 2026). For JT, the

question is not merely job numbers but job quality, geographic distribution, and accessibility to affected workers. To capture these dimensions, several evaluation metrics are employed.

First, *direct green jobs* measures employment in sectors such as renewable energy, energy efficiency, circular economy, sustainable agriculture, green infrastructure, and environmental protection. Disaggregated by skill level, gender, and formality.

Second, *job quality* can be evaluated through indicators including wage levels, benefits, job security, and working conditions.

Third, *labor transitions from declining sectors* assess the extent to which workers in fossil fuel-dependent and carbon-intensive industries are successfully reabsorbed into emerging green sectors. Relevant indicators include the number of workers transitioned from fossil fuel and carbon-intensive industries to green sectors, success rate and quality of transitions, and geographic mobility considerations.

Fourth, *youth and women's participation* evaluates the inclusiveness of green labor markets. This includes the share of green jobs held by youth and women, as well as gender pay gaps in green sectors. Current green sectors such as renewable energy tend to be male-dominated; interventions are needed for inclusion.

As illustrated in Fig. 8, the share of green jobs has increased notably in most countries, while some countries see a decline, showing the challenges developing countries are faced with.

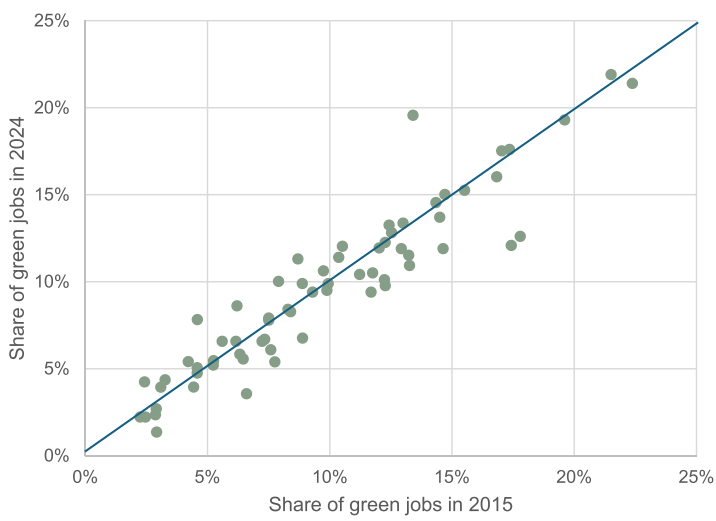
#### 4.3.4. Green foreign direct investment

Foreign investment plays a crucial role in financing green transitions, particularly for countries with limited domestic capital. However, FDI must align with national development priorities rather than merely extracting resources or serving as a carbon offset mechanism for Northern emissions. To assess this dimension, several key indicators are employed.

First, *green FDI volume and trends* capture the scale, composition, and direction of investment flows. This includes total green FDI inflows, sectoral distribution, and source country composition. As illustrated in Fig. 9, the median of Foreign direct investment as a percentage of GDP declined from 2.3% to 1.9% of GDP across G77 countries, but spectrum has grown from 23% to 34% from 2015 to 2024.

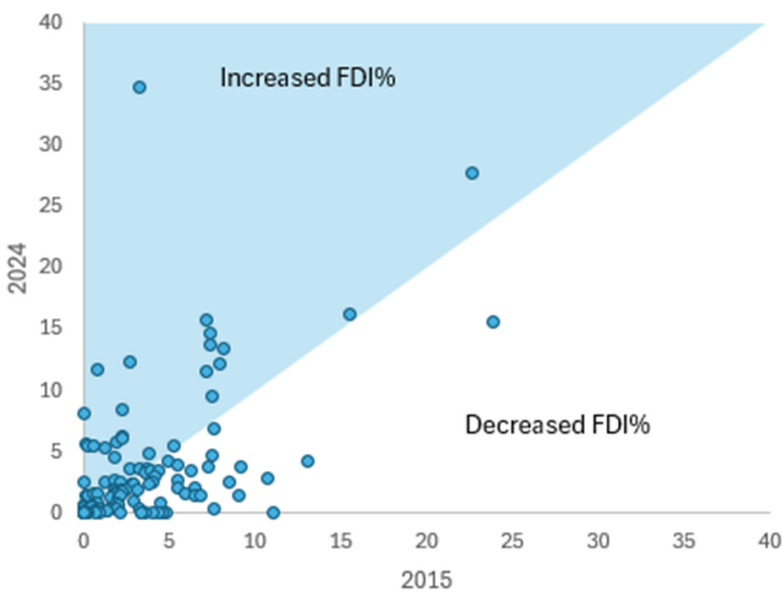
Second, *technology transfer and local capacity building* evaluate the extent to which FDI includes technology transfer, local content requirements, joint ventures with domestic firms and training and skills development for the local workforce.

In addition, *Investment terms and conditions* assess the quality and sustainability of FDI. This includes the balance between debt and equity financing, the extent of profit repatriation, adherence to environmental and social standards, and alignment with national development strategies.



*Note:* The diagonal line indicates no change; points above represent an increase, points below a decrease; This chart is an estimation assuming jobs in the following ILO sectors are “green jobs”: education and research, mechanical and electrical engineering, postal and telecommunications service, transport equipment manufacturing and utilities. When 2015 and 2024 data are not available, we use data from the neighboring year. *Data Source:* ILO (2025a).

Fig. 8. Share of Green Jobs in 2015 and 2024.



*Note:* 114 countries from G77 are included in this chart due to data availability. *Data Source:* World Bank Group, 2024.

Fig. 9. Foreign direct investment net inflow (% of GDP) for G77 countries.

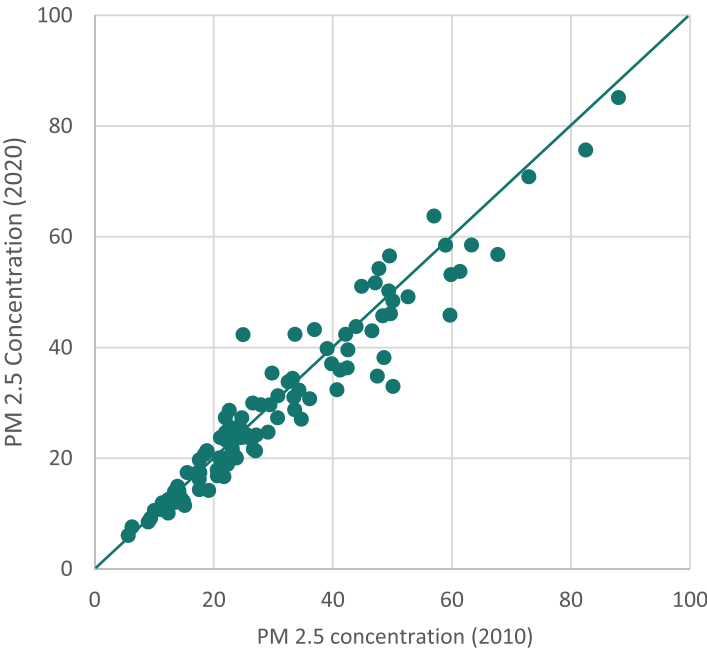
4.3.5. Environmental integrity

JT cannot sacrifice environmental quality for development. This dimension evaluates whether transition efforts are achieving genuine environmental improvements rather than merely relocating pollution or degrading ecosystems. Several key indicators are employed to assess environmental outcomes.

First, *air quality* can be measured through concentrations of particulate matter (PM2.5 and PM10) in urban areas; Days exceeding World Health Organization (WHO) air quality guidelines; Respiratory health impacts. Particularly important in rapidly industrializing Southern countries. As shown in Fig. 10, PM2.5 concentrations have evidently reduced from 2010 to 2020 in G77 countries in general.

Second, *water quality and availability* assess both the condition and sustainability of water resources. Indicators include surface and groundwater quality, water stress indicators, and industrial effluent treatment. Many green technologies (e.g. lithium extraction, hydropower) have water implications.

Third, *biodiversity and ecosystem health* evaluate the extent to which natural systems are preserved and restored during the transition. Relevant measures include protected area coverage and effectiveness, ecosystem degradation rates,



*Note:* The diagonal line indicates no change; points above represent an increase, points below a decrease.

*Data Source:* World Bank Group, 2024.

Fig. 10. PM2.5 concentration change from 2010 to 2020 in G77 countries.



and critical habitat preservation. Renewable energy infrastructure (wind farms, hydropower, biofuels) can impact ecosystems.

Fourth, *waste management and circular economy performance* capture the efficiency of material use and disposal systems. Indicators include waste generation rates, recycling and composting rates, e-waste management (particularly important as electronics proliferate), and plastic pollution reduction.

#### 4.4. Readiness and capacity

The third pillar evaluates whether countries possess the fundamental conditions and capabilities required to pursue JT effectively. Even with clear goals and well-designed pathways, countries may lack the institutional, financial, human capital, and social infrastructure to implement the transition to ensure the transition engages all stakeholders.

##### 4.4.1. Social security and safety net

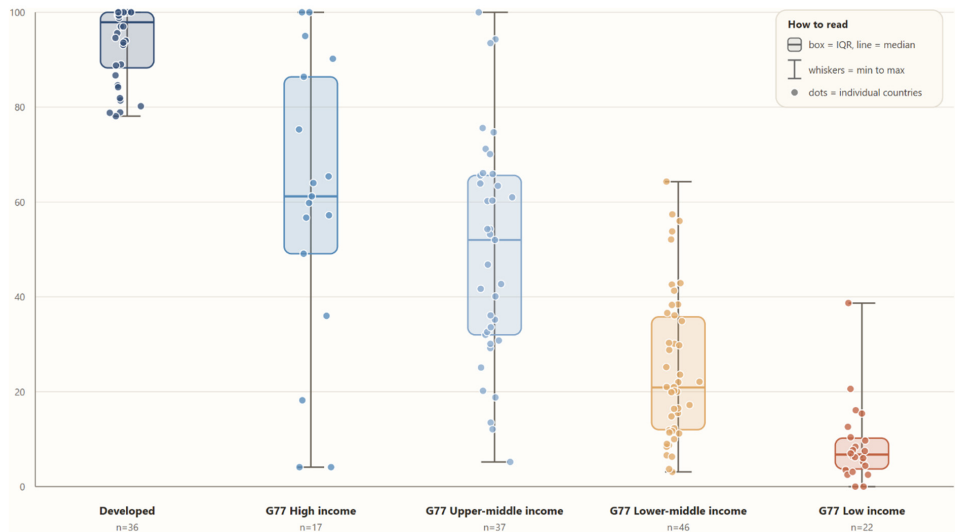
Robust social protection systems are foundational for managing transition risks. Without adequate safety nets, political resistance to necessary transformations can be insurmountable as workers and communities fear for their livelihoods. This dimension is assessed through several key components.

First, *unemployment insurance and active labor market policies* evaluate the extent to which workers are protected against income loss and supported in re-entering the labor market. Relevant indicators include coverage and adequacy of unemployment benefits, job search assistance, and wage subsidies for transitions to green sectors. Many Southern countries lack comprehensive unemployment insurance systems.

Second, *skills development and reskilling systems* assess the capacity of economies to support workforce transformation. This includes investment in technical and vocational education, reskilling programs targeted at workers from declining sectors, and apprenticeship and on-the-job training opportunities in green sectors.

Third, the ILO emphasizes sectoral labor mobility and workforce transformation through reskilling. As transition costs often fall disproportionately on the poor and vulnerable groups, *social assistance for vulnerable populations* captures the extent to which safety nets protect those most at risk of exclusion. Indicators include cash transfer programs, subsidies for essential services (energy, transport, food), and healthcare and education access.

Fourth, *pension systems and retirement security* evaluate protections for older workers who may be unable to transition into new forms of employment. This includes early retirement options for older workers in declining sectors, pension portability, and adequate pension levels. As shown in Fig. 11, G77 countries have much lower and much more unequal social protection coverage than developed countries. Income level and regional development pattern appear to be the clearest drivers.



Note: Income groups based on World Bank 2026 categorization. Data Source: ILO (2025b).

Fig. 11. Share of population covered by at least one social protection benefit.

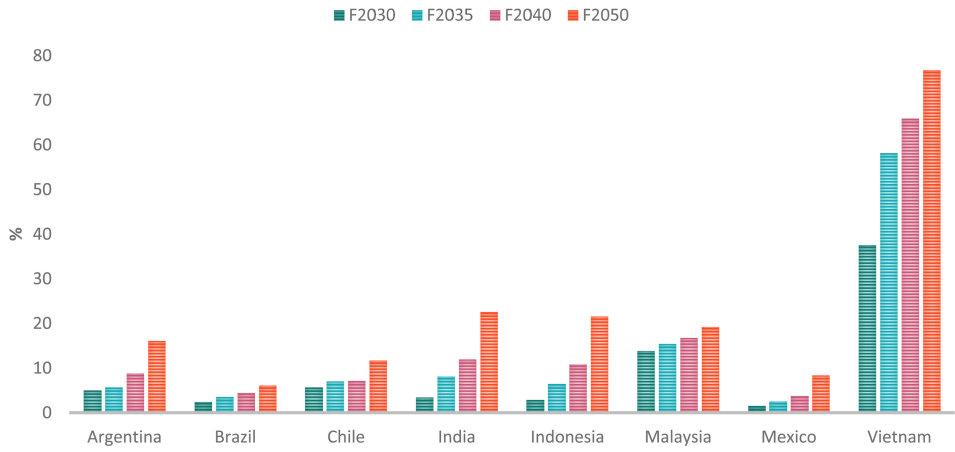
#### 4.4.2. Economic resilience

To assess the economic resilience of countries, several indicators can provide valuable insights into how nations might recover from or mitigate the impact of climate-related challenges, helping us to understand their resilience to climate shocks.

First, *potential national income gains from avoided climate damages* reflect the economic advantage gained by avoiding the long-term consequences of climate change through proactive policies. In essence, it shows the economic value that can be “saved” by transitioning to green policies or adopting Net Zero scenarios. This is a critical measure of resilience because it demonstrates a country’s ability to shield its economy from future climate-related disruptions, thereby ensuring stable growth.

Figure 12 shows the economic benefit of transitioning to Net Zero policies, illustrating how each country stands to gain by adopting green policies. This benefit is reflected as a positive value, particularly in the long term (e.g. by 2050), which supports the argument that investing in green policies not only mitigates climate damages but can also stimulate long-term economic growth. Countries with higher benefits, such as Argentina, Brazil, and Mexico, demonstrate strong resilience to climate damages under the Net Zero scenario, showing that they are likely to experience substantial positive economic outcomes by pursuing a low-carbon future.

Second, *potential national income losses from climate risks* quantify the economic loss a country might experience due to climate risks under current policies.

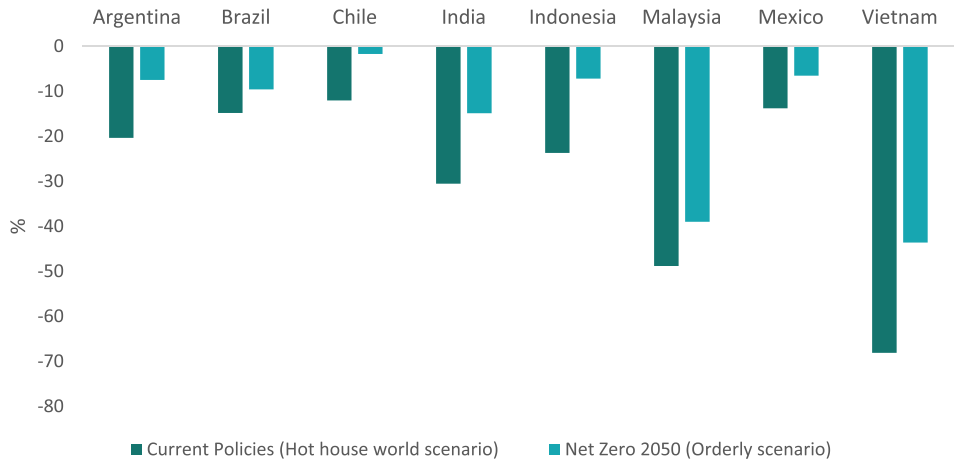


*Data Source:* International Institute for Applied Systems Analysis (IIASA) (2023), Network for Greening the Financial System (NGFS) (2023), International Monetary Fund (IMF) Staff Calculations.

Fig. 12. Potential national income benefit from avoided climate damages under net zero 2050 scenario.

It represents the “starting point” or vulnerability of the economy in the face of unmitigated climate change impacts. The extent of these losses directly links to a nation’s vulnerability and how prepared or unprepared it is to handle climate shocks.

Figure 13 presents the Current Policies scenario, which reflects the economic losses each country could face due to climate risks if existing policies are



*Data Source:* International Institute for Applied Systems Analysis (IIASA) (2023), Network for Greening the Financial System (NGFS) (2023), IMF Staff Calculations.

Fig. 13. Potential national income loss from climate risks (2050).

maintained. Negative values indicate the magnitude of economic losses due to unmitigated climate impacts. The Net Zero 2050 scenario shows the potential reduction in these losses if countries shift to green policies by 2050. This scenario is designed to demonstrate how transitioning to Net Zero could significantly mitigate future economic losses. Countries such as Vietnam and Malaysia face substantial economic losses under the Current Policies scenario, but these losses decrease notably under a shift to the Net Zero scenario, illustrating the potential resilience gained from adopting climate-friendly policies.

#### 4.4.3. *International JT financing mechanisms*

Access to adequate affordable climate finance is a critical readiness factor for countries in the Global South. Despite repeated commitments, international climate finance remains insufficient and often poorly structured. This dimension is assessed through two principal components.

First, *climate finance flows and sources* evaluate both the volume and composition of financial resources available for transition. Key indicators include total climate finance received, composition (grants, concessional loans, non-concessional loans, equity), and sources (multilateral, bilateral, private).

Second, *access and conditionality* assess the extent to which climate finance is practically available and aligned with national priorities. This includes the ease of access, application and reporting requirements, and policy conditionalities attached. Many countries report that accessing climate finance is complex and burdensome.

#### 4.4.4. *Research, development, and innovation capacity*

Countries' ability to innovate, adapt technologies, and develop context-appropriate solutions is crucial for a successful transition. Over-reliance on imported technology creates dependency and limits value capture. This dimension is evaluated across several key components.

First, *research and development (R&D) investment* measures the scale of public and private expenditure on innovation, expressed as a share of GDP. Attention is given to public and private R&D spending as a percentage of GDP, and R&D specifically in clean energy and sustainability.

Second, *patent and innovation outputs* assess the tangible results of innovation systems. Relevant indicators include the number of green technology patent applications and grants, scientific publications in climate and energy fields and commercialization of research findings.

Third, *technology transfer and adaptation* evaluate the mechanisms through which countries access and internalize external knowledge. This includes mechanisms for accessing and adapting foreign technologies, licensing agreements, and research partnerships with developed countries and leading Southern countries.

Finally, *higher education and research institutions* capture the human capital and institutional foundations of innovation. Indicators include university capacity in climate science, renewable energy engineering, environmental studies, links between academia and industry, and graduate production in relevant fields.

#### 4.4.5. Governance and institutional capacity

Effective governance structures are essential for planning, coordinating, and implementing complex, multi-sectoral JTs. This dimension is assessed across several key components.

First, *integrated climate governance* evaluates the extent to which institutional arrangements facilitate coordination across sectors and levels of government. This includes the presence of institutional frameworks coordinating climate action across ministries, climate mainstreaming in sectoral policies, and coherence between NDCs, long-term strategies, and development plans.

Second, *stakeholder engagement mechanisms* assess the inclusiveness and participatory quality of transition processes. Relevant indicators include the formal structures for worker, community, and civil society participation in transition planning, social dialogue institutions, and indigenous peoples' consultation processes. The G20 principles emphasize "whole-of-society" approaches.

Third, *monitoring, reporting, and verification (MRV) systems* capture the capacity of governments to track progress and ensure accountability. This includes the capacity to track progress on goals and pathways, transparency in reporting, and data availability and quality. UNDP found that 93% of African NDCs demonstrated strong transparency efforts.

Finally, *policy and regulatory frameworks* assess the extent to which legal and policy instruments support the transition. This includes legislation supporting JT, renewable energy policies, carbon pricing or equivalent mechanisms, and JT provisions in mining, energy, and industrial policies.

## 5. Conclusion

The imperative of a JT is unequivocal: rapid decarbonization is essential to efforts to avert catastrophic climate change, yet this transformation must simultaneously advance, rather than undermine, human welfare and development. Nowhere is this dual challenge more acute than in the Global South, where countries face disproportionate climate risks despite limited historical responsibility, while also confronting persistent development deficits and structural constraints in accessing emerging green opportunities.

This paper has argued that a Global South perspective requires a fundamental reframing of JT. Rather than treating social and development concerns as secondary to climate mitigation, sustainable development objectives must be understood as co-equal and mutually reinforcing with climate goals. Accordingly, the

success of transition should be evaluated not only in terms of emissions reduction or the management of socio-economic losses, but also in relation to countries' ability to capture green economic opportunities, expand affordable access to essential services, and build the productive and institutional capacities necessary for long-term structural transformation.

To operationalize this perspective, the paper proposed a comprehensive yet flexible analytical framework structured around three pillars: *Goals, Pathways, Readiness and Capacity*. The framework thus gives operational meaning to a country-led, SDG-aligned, and people-centered JT, moving these principles from rhetoric to measurable actions.

Across the Goals pillar, our analysis reveals broadly positive but uneven progress among developing countries. Of the 66 countries assessed, 78.8% report being on track toward their NDCs, with over one-fifth either off track or uncertain. Climate ambition is also deepening, with most countries moving beyond CO<sub>2</sub>-only targets toward multi-gas coverage and an increasing incorporation of short-lived climate pollutants. At the same time, structural barriers persist, including emissions growth linked to development needs, limited deployment of advanced clean technologies, and heavy reliance on international finance. Moreover, energy system transformation remains highly uneven: while renewable capacity and share are expanding globally, stark disparities persist in per capita access and infrastructure, and improvements in energy intensity. Similarly, forest and land-use trends diverge sharply, with policy-driven gains in some countries contrasted by continued deforestation in other regions due to economic pressure.

Under the Pathways pillar, the findings highlight that the distribution of transition opportunities is highly asymmetric. Participation in emerging green value chains remains concentrated in countries such as China. While most developing countries occupy upstream or low-value segments, some countries demonstrate rapid industrial upgrading in renewable production and electric vehicle and battery production. Green job creation is also accelerating, but significant gaps remain in job quality, labor mobility, and inclusiveness, particularly for women and informal workers. Environmental indicators show partial improvements, such as declining PM<sub>2.5</sub> concentration in the past decade.

The Readiness and Capacity pillar underscores that structural capacity constraints remain the principal bottleneck for a JT in the Global South. Social protection systems are generally weak and uneven, limiting governments' ability to manage transition risks and maintain political support. At the macro level, scenario analysis demonstrates that net-zero pathways generate substantial long-term economic benefits and reduce climate-related losses, but these gains are unevenly distributed and contingent on policy shifts. Access to climate finance emerges as a systemic constraint: beyond insufficient volume, countries face complex procedures and misaligned conditionalities that hinder effective utilization. Innovation capacity is similarly concentrated, with many countries reliant on imported technologies, constraining domestic value capture. While governance systems — particularly

monitoring and reporting — are improving, persistent gaps in coordination, stakeholder engagement, and policy coherence limit implementation effectiveness.

The three-pillar framework also helps to differentiate policy priorities across country types. For LDCs, the most binding constraints lie in the Readiness and Capacity pillar — weak social protection systems, limited fiscal space, and poor access to climate finance. Their immediate efforts should therefore focus on establishing basic safety nets and streamlining concessional finance. For SIDs, the pathways pillar demands attention to green service accessibility and climate-resilient infrastructure, alongside international support for loss and damage. For emerging economies such as Indonesia, South Africa, and Brazil, the goals and pathways pillars become central: they need targeted industrial policies, workforce reskilling, and investments in innovation to capture higher value in green value chains. By diagnosing which pillar is weakest in a given national context, the framework enables context-specific strategies rather than one-size-fits-all prescriptions.

Beyond evaluation, the framework provides a foundation for action by supporting countries in translating assessment into context-specific transition strategies. This involves three interrelated steps: first, conducting a systematic and participatory assessment of current performance, transition opportunities, and capacity gaps; second, defining a country-specific vision that reflects national circumstances, resource endowment, and development priorities; and third, designing integrated policy packages that align industrial, energy, labor, financial, and educational policies toward shared transition objectives.

A central implication of this approach is that JT is inherently an economy-wide and society-wide process. Effective implementation requires coordinated policy interventions across sectors, the mobilization of both domestic and international funding sources, and sustained investment in skills, innovation, and institutional capacity. Given the scale of required investment, developing countries must pursue diversified financing strategies, combining domestic resource mobilization with concessional international support and mechanisms to leverage private capital. At the same time, the current global financial architecture remains insufficient and misaligned with the needs of the Global South, underscoring the importance of reform efforts aimed at increasing the scale, accessibility, and equity of climate finance.

International cooperation remains indispensable. While transition pathways must be country-led, they cannot be country-isolated. South–South cooperation, regional integration, and collective engagement in global governance platforms — such as the G20 and BRICS — can enhance bargaining power, facilitate technology exchange, and support more equitable participation in global value chains. At the same time, developed countries bear a continuing responsibility to provide adequate finance, enable technology transfer, and support capacity building in line with principles of international equity.



Equally critical is the role of inclusive governance. JT processes must be grounded in meaningful participation by workers, communities, and civil society, which are needed to ensure that transition pathways are socially legitimate and responsive to diverse needs. Without such inclusion, even well-designed policies risk generating resistance and exacerbating existing inequalities.

Ultimately, the transition to low-carbon development in the Global South is not merely a technical or environmental challenge, but also a deeply political and developmental process. It requires navigating trade-offs, economic restructuring, and the redistribution of opportunities and risks within and across societies. The framework advanced in this paper contributes to this effort by providing a structured yet adaptable approach to linking climate ambition with development transformation.

The pathway toward a truly just and sustainable future will be complex and contested. Yet it is both necessary and urgent. The outcomes of this transition will shape not only the trajectory of global emissions, but also the prospects for equitable development and human well-being for decades to come.

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