



The System Changes, Inequality Does Not: Green Growth, Climate Governance, and Persistent Global Inequalities

Gala Kumec

Universidad Nacional de San Martín

gkumec@gmail.com

Abstract

This article examines climate change as a systemic outcome of global inequality rather than a purely environmental failure. Drawing on a world-systems perspective, it argues that the contemporary climate crisis is embedded in the asymmetric distribution of economic, technological, and political power that structures the global order. The analysis focuses on three interconnected arenas—economic, technological, and political—through which climate-related inequalities are produced and reproduced.

In the economic arena, the green transition unfolds within deeply uneven global value chains, allowing countries in the Global North to sustain high levels of consumption while externalizing ecological and social costs to the Global South. The technological arena shows how digitalization and low-carbon technologies reinforce new forms of dependency through intellectual property regimes, data extraction, and control over critical minerals. In the political arena, multilateral climate governance remains shaped by Northern preferences, market-oriented mechanisms, and technocratic decision-making, limiting the scope for addressing historical responsibility and redistribution.

By situating climate change within these intersecting arenas, the article demonstrates that inequality is not an unintended side effect of climate policy but a politically produced condition that shapes vulnerability and response capacity. The climate crisis thus appears as a manifestation of a broader crisis of the global order, one that cannot be addressed without redistributing power and reorienting global governance toward planetary limits.

Keywords: Climate Inequality, Ecologically Unequal Exchange, Techno-colonialism, Climate Governance, Global South



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Introduction

The architecture of the global order is currently traversing what Antonio Gramsci described as a moment of interregnum: an ambiguous phase in which the old is no longer able to govern, yet the new has not fully emerged. The legitimacy of the international system is being eroded by a phenomenon that goes beyond the mere coexistence of multiple crises. Rather, it reflects a dynamic in which different fronts—climatic, geopolitical, technological, and democratic—interact in complex and mutually destabilizing ways. Conceptualized as polycrisis (Lawrence et al. 2022), this dynamic is not simply an accumulation of problems. What is taking shape is a scenario in which crises become intertwined and reinforce one another, overwhelming traditional capacities for response and calling into question not only established solutions, but the very architecture of the system itself.

Within this context of polycrisis, the environment emerges as the most global and multidimensional arena of international politics, condensing the economic, social, and geopolitical tensions of the contemporary order. Far from constituting an isolated issue, climate change expresses a web of interdependent processes that cut across all dimensions of social life. Among its most visible manifestations is the deepening of inequality, a structural symptom of an order in decline.

Decades of neoliberal globalization have privileged private capital through the privatization of public assets, natural resources, and essential services (Ghosh 2022), concentrating wealth in multinational corporations while weakening states' regulatory capacity and environmental protection mechanisms. In doing so, neoliberal globalization consolidated a global economic model led by large corporations, whose central objective—profit accumulation—prevails even at the expense of the ecological systems that sustain life. Reliance on the market as the primary mode of economic organization has concentrated both wealth and decision-making power, thereby deepening inequalities across all scales. A clear illustration of this dynamic is provided by the “Big Three”—BlackRock, Blackstone, and Vanguard—which manage close to 26 percent of global private wealth, assets equivalent to nearly three times Latin America's GDP. Such concentration grants these actors structural power to shape development models and investment strategies characterized by short-term horizons and limited accountability (Jenkins 1996; Clapp and Helleiner 2012).

This concentration of economic power is mirrored at the international level. Inequality between countries continues to widen, reproducing a center-periphery pattern that constrains the development prospects of states with lower accumulation capacity. While countries in the Global North are able to invest in technology and education, consolidating their position within the

emerging digital economy, many countries in the Global South struggle to sustain basic healthcare systems or finance public education. Since the pandemic, this gap has further expanded: by 2023, more than half of the countries with low Human Development Index (HDI) scores had not recovered to pre-COVID-19 levels, in contrast to the full recovery observed among countries with high HDI (Programa de las Naciones Unidas para el Desarrollo, [PNUD] 2024). These dynamics are compounded by trade tensions and an escalating debt crisis, which further restrict states' policy space.

At the population scale, climate inequality reflects an ecologically unequal exchange that sustains the living standards of the Global North at the expense of ecosystems and populations in the Global South. Between 2015 and 2023, the richest 10 percent of the world's population accounted for 52 percent of cumulative emissions (Oxfam 2024). This extreme concentration of emissions underscores the class-based nature of climate responsibility, revealing how patterns of consumption among high-income groups are structurally embedded in global production networks that externalize environmental costs to the periphery. Material well-being in the North is thus underpinned by a systematic transfer of energy, materials, and waste toward the South, where the most resource-intensive and environmentally damaging activities are concentrated under weaker regulatory frameworks (Roca Jusmet and Padilla 2021).

At the same time, private wealth is growing eight times faster than public wealth, while states curtail social and environmental spending, reinforcing a development model that rewards accumulation and systematically externalizes its costs (Taneja et al. 2025). In sum, the quality of life in the Global North constitutes the core of an ecologically inefficient and unjust system: its overconsumption has saturated the atmosphere and generated a historical ecological debt, the burden of which falls disproportionately on peripheral countries—the least responsible for the climate crisis (Jenkins 1996). As global inequality deepens, international governance becomes increasingly fragile, and societies grow more vulnerable to the impacts of climate change.

This article advances beyond existing literature in three respects. First, it integrates economic, technological, and political dimensions of climate inequality into a single causal model. Second, it introduces techno-colonialism as a category for analyzing contemporary world-system dynamics, showing how artificial intelligence and intellectual property constitute new extractive frontiers. Third, it formulates testable propositions to operationalize the framework for future empirical research.

Building on this diagnosis, the following sections develop three dimensions of contemporary inequality—economic, technological, and political—examining their interconnections with the climate crisis and the structural tensions of the global order.

Theoretical and Methodological Framework

Conceptual Definitions

To analyze the relationship between climate crisis and global inequality, this article begins with a precise definition of its core concepts. Green growth refers to the strategy that seeks to decouple economic growth from carbon emissions through clean technologies and market mechanisms. Green transition refers to the process of transforming energy, productive, and mobility systems toward low-carbon models, though without necessarily questioning the logic of capitalist accumulation (Bertinat and Chemes 2022). Climate governance designates the set of institutions, norms, and procedures —both multilateral and private— that regulate global climate action (Clapp and Helleiner 2012). Techno-colonialism is defined as the contemporary form of domination that operates not through direct territorial control, but through the ownership and governance of the technological infrastructures that underpin economic activity and daily life (Hermann and Hazem 2024). Ecological debt designates the historical responsibility of industrialized countries that have exceeded their fair share of the global carbon budget, appropriating environmental space without compensation (Borrás 2006; Roberts & Parks 2009; Rice 2009; Azamar-Alonso and Carrillo-González 2017).

Additionally, the article draws on two structural concepts from world-systems theory (Wallerstein 1974; 2004). Center-periphery refers to the hierarchical division of the global system, where center countries concentrate capital, technology, and political power, while peripheral countries provide raw materials, cheap labor, and markets for the center's industrial production (Simpson 2018; Ghosh et al. 2023). It is important to note that this distinction should not be interpreted as a rigid dichotomy or as a homogeneous characterization of each bloc. World-systems theory incorporates the concept of semiperiphery to account for countries that combine characteristics of both poles (such as Brazil, India, South Africa, Turkey, or Indonesia). These states can simultaneously experience dependency relations vis-à-vis the center and exercise forms of exploitation or extraction over the periphery. Likewise, the Global South itself is internally heterogeneous: there are deep intra-Global South inequalities in terms of income, technological capacity, productive structure, and climate vulnerability. This article acknowledges this heterogeneity and, when referring to the "Global South" or "Global North," does so as an analytical shorthand that does not intend to erase internal asymmetries or semiperipheral dynamics. Unequal exchange designates the mechanism through which prices of peripheral products tend to decline relative to manufactured goods from the center, systematically transferring value from the South to the North (Hornborg 2003). Ecologically unequal exchange is the environmental version of this phenomenon: the net transfer of natural resources, energy,

and labor from the South to the North without equivalent compensation (Rice 2007; Roberts and Parks 2009; Dorninger et al. 2021; Hickel et al. 2022).

Regarding inequality, this article distinguishes three interrelated levels: (a) inequality between states (center-periphery), (b) intra-state class-based inequality (as shown by the fact that the richest 10% of the world's population emit more than half of global carbon), and (c) relational inequality, understood as a process of ecologically unequal exchange that systematically transfers resources, energy, and labor from the South to the North.

Causal Model: Mechanisms, Actors, and Connections

The central causal claim of this article can be summarized in the following model: structural asymmetries in global value chains generate cumulative advantages for Northern countries in the technological and financial spheres; these advantages translate into knowledge monopolies and control over digital infrastructures and critical minerals; these monopolies, in turn, shape climate governance institutions in ways that reflect Northern interests (market mechanisms, technocratic solutions, dilution of historical responsibility); and this political configuration reinforces initial economic asymmetries, closing a cycle of inequality reproduction. The key actors operating in this system are: multinational corporations (especially asset managers such as BlackRock and Vanguard), Northern states with technological and financial capacity, international financial institutions (IMF, World Bank), and climate governance bodies (United Nations Framework Convention on Climate Change [UNFCCC]). The connection among the three arenas is not merely additive but mutually constitutive: economic inequality enables technological dependency, and both restrict the political options of the Global South, which in turn prevents a redistributive reallocation of resources. To make these relationships explicit, Table 1 presents a causal diagram that visually synthesizes the mechanisms described.

Arena	Central mechanism	Key actor(s)	Effect on inequality
Economic	Ecologically unequal exchange / external debt	Multinational corporations, Northern states, IMF/World Bank	Net transfer of resources, energy, and labor South→North

Technological	Intellectual property monopolies / control over critical minerals	Large tech firms, high R&D investment countries (US, China)	Technological dependency of the South, loss of digital sovereignty
Political	Marketized climate governance (carbon markets, CBAM)	UNFCCC, Northern states, international financial institutions	Dilution of historical responsibility, cost externalization

Methodological Strategy: A Theoretical Synthesis

This article does not present primary empirical research but rather belongs to the tradition of theoretical synthesis and conceptual integration. Its objective is to build an analytical framework that articulates findings dispersed across different subdisciplines to offer a unified view of the relationship between climate crisis and global inequality. The evidence strategy consists of the review, systematization, and re-interpretation of existing academic literature, complemented by aggregated statistics from reliable sources (United Nations, Oxfam, UNESCO, WIPO, among others).

Four bodies of literature were prioritized, selected for their direct relevance to the three arenas of analysis:

1. World-systems theory and dependency theories (Wallerstein 1974; 2004; Simpson 2018; Ghosh et al. 2023), which provide the center-periphery framework and the concept of unequal exchange.
2. Literature on ecologically unequal exchange and ecological debt (Hornborg 2003; Rice 2007; Roberts and Parks 2009; Dorninger et al. 2021; Hickel et al. 2022), which quantifies and conceptualizes North-South transfers of resources, energy, and labor.
3. Political economy of climate governance (Clapp and Helleiner 2012; Ghosh 2022; Rodrik 2023), which analyzes the structural biases of multilateral institutions and market mechanisms.
4. Critical political economy of technology (Hornborg 2003; Malm & Hornborg 2014; Simpson 2018; Hermann and Hazem 2024), which examines asymmetries in intellectual property, data, and critical minerals.

The selection logic of these bodies of literature responds to the need to cover each of the three arenas announced in the title: the economic arena draws mainly on (1) and (2); the

technological arena on (1) and (4); the political arena on (2) and (3). The use of aggregated statistics has an illustrative, not demonstrative, purpose: the figures cited (emission percentages, patents, external debt, etc.) serve to make visible the magnitude of inequalities, not to prove causal relationships, whose theoretical foundation lies in the specialized literature.

The Three Arenas of Climate Inequality

Inequality in the Economic Arena

Economic inequality constitutes the structural foundation of the contemporary world order, shaped over the last two centuries through a center–periphery dynamic. From its inception, this system has been organized around the expansion of industrialized economies in the Global North through the systematic extraction of value from the Global South, consolidating dependent economic structures oriented toward the provision of raw materials and cheap labor. These enduring relations of dependency continue to constrain the development prospects of peripheral countries.

International trade has been a central mechanism through which this structural inequality has been reproduced. Although commonly framed as a system of mutual benefit, global trade in practice operates as a form of structural extraction that redistributes value from the South to the North. High-income economies rely on resource- and energy-intensive industrial infrastructures whose functioning depends on sustained net transfers of materials, energy, and labor from peripheral regions. This asymmetry is reflected in patterns of value addition: for each ton of raw material exported, high-income countries capture, on average, eleven times more value than low-income countries, and twenty-eight times more per unit of embodied labor (Hickel 2020).

Taken together, this ecologically unequal exchange enables Northern economies to appropriate both natural resources and monetary surplus through international trade. According to Hickel et al. (2022), in 2015 the Global North appropriated net transfers from the Global South amounting to 12 billion tons of raw materials, 822 million hectares of land, 21 exajoules of energy, and 188 million person-years of labor, with an estimated value of USD 10.8 trillion at Northern prices—an amount sufficient to eradicate global extreme poverty seventy times over (World Bank 2021). These flows constitute net appropriation, because they are not compensated through equivalent economic returns but are effectively transferred without remuneration.

This pattern of unequal exchange constitutes one of the main drivers of global inequality, uneven development, and ecological breakdown. It cannot be explained solely by differences in productive structures, but rather by the interaction of three persistent factors: restrictions on labor mobility, monopolistic market structures, and the geopolitical power relations that sustain an imperial world order (Dorninger et al. 2021; Althouse et al. 2023). These dynamics extend

beyond the economic sphere and acquire a distinctly ecological dimension, giving rise to what critical political economy has conceptualized as ecologically unequal exchange.

Roberts and Parks (2009) define ecologically unequal exchange as the structural pattern through which countries in the Global North benefit from net inflows of natural resources and energy from the Global South. Drawing on structuralist traditions, they argue that the prices of peripheral exports tend to decline relative to manufactured goods from the North, as the social and environmental costs of extraction are systematically excluded from market prices. This omission produces a double effect: it distorts conditions of production and competition by undervaluing Southern labor and nature, and it enables Northern economic actors to appropriate environmental benefits without bearing the associated ecological costs, thereby externalizing environmental degradation onto exporting countries.

The preceding analysis suggests three empirically testable propositions. First, countries with higher external debt-to-GDP ratios will tend to exhibit higher rates of extractive activity (mining, agribusiness, fossil fuel expansion) and lower levels of public investment in climate adaptation and mitigation, controlling for GDP per capita and institutional quality. Second, the greater the net transfer of materials, energy, and labor from a peripheral country to the center, the lower its capacity to achieve sustainable development outcomes, measured by the Sustainable Development Goals (SDG) index. Third, green growth strategies that rely on market mechanisms and technological fixes without restructuring global value chains will tend to reproduce, rather than reduce, the ecological debt owed by the Global North to the Global South.

This externalization of environmental costs has been further institutionalized through global mechanisms such as carbon markets. Carbon credits originating in the Kyoto Protocol normalize a "right to pollute" that conceals deep structural asymmetries: while some territories absorb the environmental damage associated with extraction and conservation, others preserve their environmental quality through financial compensation. Roberts and Parks (2009) conceptualize this process as the appropriation of environmental space, a notion expanded by Peinado (2019) to emphasize that international trade relations are not only economically unequal, but also ecologically unequal. In a convergent line of analysis, Rice (2009) introduces the concept of socio-ecological subsidy, whereby indebted countries in the Global South subsidize high levels of consumption in the Global North through their labor, energy, and natural resources. In highly unequal terms, a relatively small share of the global population accounts for the majority of material and energy use, underscoring the structural dependence of Northern well-being on Southern ecological depletion (Rice 2009; Dorninger et al. 2021).

These dynamics have been widely conceptualized as ecological debt (Borrás 2006; and Roberts & Parks 2009; Rice 2009; Peinado 2019), a concept that captures the historical

responsibility of industrialized countries that have exceeded their fair share of the global carbon budget while appropriating environmental space without compensation. Under principles of intergenerational and international equity, carbon budgets should be distributed proportionally across countries (Anderson and Bows 2011; Intergovernmental Panel on Climate Change [IPCC] 2022). Yet the Global North has systematically overshoot its share: between 1850 and 2008, it represented only 18.8 percent of the world's population while generating 72.7 percent of cumulative CO₂ emissions (Malm and Hornborg, 2014). According to Fanning and Hickel (2023), the United States, the European Union, and the United Kingdom together account for nearly two-thirds of the total financial compensation required from over-emitting countries. This historical pattern of over-appropriation translates into an estimated climate debt of USD 192 trillion to be transferred from North to South by 2050, reinforcing the structural and cumulative character of global ecological inequality.

This over-appropriation is not merely a legacy of past emissions, but an ongoing structural process reproduced through interlocking financial and institutional mechanisms that constrain the ecological and developmental choices of the Global South. Rather than operating in isolation, ecological inequality emerges from a mutually reinforcing configuration of global economic dynamics, within which sovereign debt regimes play a central role in disciplining the ecological capacity of peripheral economies.

External debt constrains state policy space by prioritizing fiscal adjustment, export-led growth, and debt servicing over social investment and environmental protection. As a result, countries in the Global South are often compelled to intensify extractive activities—mining, agribusiness, fossil fuel expansion, and deforestation—in order to secure foreign exchange, even when such activities undermine long-term ecological resilience. In this sense, financial debt operates as a mechanism of ecological coercion: it locks peripheral economies into resource-intensive development paths while transferring environmental burdens outward and upward along the global hierarchy. Rather than enabling sustainable transitions, debt dependence reinforces a growth imperative that subordinates ecological limits to the requirements of capital accumulation and macroeconomic stability.

A concrete illustration of this mechanism is lithium extraction in the Lithium Triangle (Chile, Bolivia, Argentina). The global transition to electric vehicles has generated soaring demand for this critical mineral, often framed as a "green" resource. Yet extraction is largely controlled by foreign corporations (from China, the United States, and Australia) under concession contracts that deliver marginal fiscal revenues to host countries. Extraction consumes vast quantities of freshwater in arid ecosystems, generating social conflict with Indigenous communities over water rights and land use. Processed lithium is exported as a low-value raw material, while batteries and electric vehicles are manufactured in the Global North or China.

The case shows how "green" demand does not alter structural extraction patterns: the Global South remains a supplier of cheap resources, while value addition and environmental costs follow a familiar center-periphery logic (Azamar-Alonso and Carrillo-González 2017; Svampa 2019).

This growth imperative has a specific historical genealogy. The debt crisis of 1982 marked the onset of a persistent financial dependency in the Global South; since then, recurrent cycles of indebtedness have reinforced extractive development strategies aimed at securing foreign exchange. Agreements with the International Monetary Fund and the World Bank, alongside Structural Adjustment Programs (SAPs), institutionalized a neoliberal model of liberalization and deregulation that secured debt repayment through the privatization of public assets and the intensified exploitation of natural resources, consolidating new forms of economic and ecological subordination (Azamar-Alonso and Carrillo-González 2017).

In the current context of environmental crisis—when states should be allocating resources to transform productive structures and implement climate mitigation and adaptation policies—the dominance of the global financial system operates as a significant constraint. While Northern economies are able to channel domestic savings into long-term productive investment, peripheral economies depend on volatile external flows to cover short-term deficits (Harvold, Koddenbrock and Sylla 2020). This pattern of chronic indebtedness limits fiscal autonomy and reduces the capacity of the Global South to protect its societies from contemporary challenges. In 2023, global public debt reached 93.2 percent of world GDP, and more than 3.3 billion people lived in countries that spent more on interest payments than on health or education (Programa de las Naciones Unidas para el Desarrollo 2025). This imbalance not only undermines economic stability, but also constrains pathways toward decarbonization and socioecological transition by subordinating climate policy to financial imperatives.

Within this scenario, a paradox emerges: many of the countries most heavily indebted financially are simultaneously ecological creditors (Cantamutto and Peinado 2024). As early as the 1992 Earth Summit, a document entitled *External Debt and Ecological Debt*, signed by twenty-one NGO representatives from eight Latin American countries, proposed compensating the ecological and social losses resulting from colonialism and exploitative foreign investment through debt swaps (Mickelson 2005).

The apparent affordability of many goods in the global economy rests on the systematic exclusion of ecological degradation and unpaid natural work from economic calculation. Were these costs fully internalized—not through market valuation but through material and biophysical limits—large segments of contemporary production would become economically unviable. This reveals not only a problem of distribution, but a deeper flaw in the very criteria of

progress that organize the global economic system. Accordingly, the climate crisis is can not to be adequately addressed solely through technological efficiency or green growth strategies; instead, it reflects a structural problem of scale that requires a deceleration of production and consumption, particularly in the Global North.

Inequality in the Technological Arena

Science, Technology, and Innovation (STI) are widely regarded as central pillars of sustainable development in the twenty-first century, offering tools with the potential to address economic, social, and environmental imbalances. Yet technologies are far from neutral. They are embedded in historically constituted power relations that shape who produces them, who gains access to them, and under what conditions they circulate globally. As Alf Hornborg (2003) argues, technology can be understood as a device designed to save time by increasing productive speed and to save space through the intensification of land use, ultimately in the service of profit maximization. Crucially, however, such localized “savings” necessarily entail the displacement of time, energy, and space costs to other parts of the global system. Technological efficiency thus rests on unequal transfers of costs and benefits across space.

In peripheral economies, structural economic scarcity compels governments to prioritize basic social needs, leaving little surplus available for sustained investment in domestic STI capacities. Innovation has therefore tended to diffuse through technology-transfer models transfer from the Global North to the Global South, consolidating new forms of dependency. As a result, global asymmetries are reproduced in the technological arena: the North accumulates industrial infrastructure and cognitive capital without substantive knowledge transfer, while continuing to appropriate energy and material resources from an increasingly impoverished periphery.

Michael Simpson (2018) traces the foundations of this unequal order to the genealogy of modern scientific knowledge itself, which emerged in Europe closely linked to notions of human progress and was subsequently exported under the banner of Western civilizational superiority. Andreas Malm and Alf Hornborg (2017) complement this perspective by showing that successive technological trajectories were shaped by private investment decisions reflecting concentrations of capital and power, producing uneven technological development across regions. Technological asymmetries thus reinforce existing socioeconomic and ecological inequalities, reproducing the center–periphery divide. In a context where climate change is global and historically driven by emissions from high-income countries, the Global North bears a differentiated responsibility to facilitate the unconditional transfer of green technologies to the

developing world, particularly given that technological monopolization constrains low-carbon pathways in the Global South.

Current data illustrate the magnitude of technological concentration. Just seven countries—the United States, China, Japan, Germany, South Korea, France, and the United Kingdom—account for nearly 80 percent of global investment in research and development (R&D) (UNESCO 2021), while approximately 90 percent of global patent applications originate in only ten countries (World Intellectual Property Organization [WIPO] 2023). These disparities are closely linked to unequal access to higher education and research capacity: high-income countries concentrate the vast majority of researchers and advanced training infrastructures, whereas low-income countries face structural barriers to technological catch-up (UNESCO 2022; World Bank 2023; Álvarez 2025). Without robust university systems, consolidated research institutions, and coherent public policy frameworks, the technological gap between North and South becomes not merely contingent, but structurally reproduced. Strengthening local innovation capacities thus constitutes a structural condition for sustainable development.

Inherited educational and scientific gaps now underpin the emerging architectures of digital power. The contemporary digital revolution is generating new forms of technological inequality and dependence. Advances in quantum computing, artificial intelligence (AI), blockchain technologies, and synthetic biology mark a new phase of capitalism in which information has become a central commodity and source of value creation (Couldry and Mejias 2019; Crawford 2021). Rather than democratizing knowledge, these technologies are giving rise to what has been described as techno-colonialism¹: a system based not on territorial control, but on the ownership and governance of the technological infrastructures that underpin economic activity and everyday life (Kwet 2019; Couldry and Mejias 2019).

Two propositions emerge from this technological diagnosis. First, the greater a country's reliance on foreign-owned cloud computing, AI models, and data storage services, the lower its capacity to regulate data flows and protect citizen privacy, controlling for GDP per capita and internet penetration. Second, green technologies that rely on proprietary AI systems and critical mineral supply chains will tend to reproduce, rather than reduce, the technological gap between center and periphery, as intellectual property regimes lock in Northern monopolies.

Geopolitical competition over artificial intelligence illustrates this dynamic. According to the 2025 AI Index Report by Stanford University's Human-Centered Artificial Intelligence

¹ The term “techno-colonialism” is used here as a synthetic category encompassing related notions of “digital colonialism” (Kwet 2019) and “data colonialism” (Couldry and Mejias 2019), rather than as a term directly employed by these authors.

initiative, China accounted for approximately 69.7 percent of all AI patents granted worldwide in 2023, far outpacing other countries and demonstrating its dominant position in technological outputs ((Human-Centered Artificial Intelligence 2025). Data from the World Intellectual Property Organization further show that China continues to lead global patent activity in emerging technologies, with its national patent office issuing more patents annually than any other country, including the United States (WIPO 2025). This concentration of intellectual property underscores the asymmetrical distribution of technological capabilities and innovation power between states and helps institutionalize structural inequalities in the global digital economy.

A concrete illustration of this technological dependency is the global geography of AI patents. According to data from the Center for Security and Emerging Technology, China filed over 87,000 AI-related patent applications in 2021, while the United States filed approximately 13,000; in contrast, the entire continent of South America filed only 120 patents, and Africa less than 50 (CSET 2026). This monopoly over AI patents means that firms and governments in the Global South must either pay high licensing fees, cede user data to foreign platforms, or remain excluded from advanced digital applications. Data generated in the South—from agricultural patterns to health records—are extracted, processed, and monetized by Northern-based corporations, while the value generated returns to the center. The case illustrates a new form of techno-colonialism: dependency is no longer primarily about raw materials, but about data, algorithms, and the infrastructures of knowledge production (Hermann and Hazem 2024).

At the same time, the training of cutting-edge AI models entails significant environmental impacts, with emissions reaching thousands of tons of CO₂ for some of the most advanced systems currently in operation (Maslej et al. 2025). The rapid decline in computing costs thus coincides with a growing ecological footprint, exacerbating inequalities between countries capable of sustaining these infrastructures and those dependent on external providers for technological access.

Taken together, these dynamics are producing an increasingly polarized geography of technological power centered on two poles—the United States and China—while much of the rest of the world, particularly Latin America and Africa, remains structurally dependent on external technological infrastructures. This configuration translates into growing losses of digital sovereignty and weakened prospects for coordinated global action at a time when planetary challenges—most notably climate change—demand collective responses.

Contemporary technological transformations therefore not only reproduce existing asymmetries of the world-system, but actively redefine the margins of autonomy and dependence among states. In the absence of a substantive shift toward equitable international cooperation in science, technology, and innovation, the current technological revolution risks consolidating a

more concentrated global order, reinforcing existing economic asymmetries and undermining both the green transition and the prospects for inclusive development.

Inequality in the Political Arena

The economic and technological asymmetries examined in the previous sections do not remain confined to the spheres of production or innovation; they translate directly into political constraints. The world's increasing inequality is therefore not merely an economic outcome, but the result of political decisions embedded in global governance structures. As financial systems, technological infrastructures, and digital platforms become increasingly concentrated, states' capacity to regulate, plan, and pursue autonomous development paths is progressively eroded. Inequality thus acquires a distinctly political dimension, reshaping sovereignty, decision-making power, and the ability of governments—particularly in the Global South—to respond collectively to global challenges such as climate change.

During the early postwar decades, global politics were oriented toward securing national objectives of full employment, prosperity, and equality; the economy was subordinated to these goals rather than the reverse. Growing international integration, however, progressively reduced states' room for maneuver vis-à-vis market forces. Contemporary inequality is, in this sense, a direct reflection of a regressive redistribution of power. There is no clearer indicator of the concentration of benefits within a small segment of the global population—those who control the means of production and the strategic decisions that sustain the status quo—than the climate crisis itself. Within this framework, traditional conceptions of progress and development begin to reveal their limits.

In this context, it is essential to recognize that global climate governance has, since the 1990s, increasingly adopted a market-based, rule-oriented approach, reinforcing structural asymmetries between countries. Mechanisms such as carbon markets, emission reduction certificates, and offset incentives have privileged technocratic solutions premised on the assumption that economic efficiency can resolve an essentially political problem. This architecture—largely designed within institutions of the Global North—has consolidated a regime in which historical responsibilities are diluted and the burden of climate action falls, de facto, on countries with the weakest institutional and fiscal capacities. Without a revision of this logic, the ecological transition risks reproducing the very inequalities that generated the crisis.

Historically, when environmental concerns entered the international agenda in the 1970s, two opposing visions emerged. On the one hand, the perspective of the Global North, crystallized in the Club of Rome report, emphasized environmental limits and warned of the potential impacts of Southern growth. On the other hand, the Global South's

perspective—articulated through the Bariloche Group—argued that the central problem was fundamentally sociopolitical, rooted in the unequal global distribution of power and wealth, and that solutions therefore required profound transformations of the dominant social order (Estenssoro and Devés 2013). The environmental constraints advocated in the United States and Europe as a necessary adjustment were perceived in poorer countries as a threat to their development prospects. Despite the clarity of these opposing positions, existing power structures largely preserved the status quo.

These dynamics shaped subsequent debates. Throughout the 1990s and 2000s, a technocratic and depoliticized approach to climate governance became dominant, marked by the proliferation of metrics, indicators, models, and standardized mechanisms. As climate change was reframed as a problem of “efficient management,” discussions of historical justice, equity, and redistribution were progressively displaced. Core political questions—over who should reduce emissions, who should finance the transition, and who should access resources—were increasingly treated as technical rather than political issues. This shift obscures the fact that the costs and benefits of the transition are distributed in deeply uneven ways.

In 2000, the Millennium Development Goals (MDGs) were defined, largely without active participation from the Global South. A significant advance came only with the Sustainable Development Goals (SDGs) in 2015, which incorporated the principle of common but differentiated responsibilities already articulated at the 1992 Rio Summit (Tassara and Cecchini 2016). Yet this principle coexists with severe limitations in climate finance: the USD 100 billion pledged annually by the Global North has arrived late, largely in the form of loans rather than grants, and at levels far below estimated needs for adaptation and mitigation. The result has been the consolidation of new financial dependencies that restrict policy space in the Global South and condition national development strategies.

In parallel, the United Nations Environment Programme (UNEP) promoted the concept of the green economy as a response to the climate crisis. This proposal seeks to redirect investment toward “sustainable” sectors without altering the global power structure (Lander 2023). Converging with this approach, the Organisation for Economic Co-operation and Development (OECD) and the World Bank advanced the strategy of green growth, which aims to maintain economic expansion and GDP growth through renewable energy and technological innovation. These initiatives, however, share a central omission: the large-scale deployment of renewable energy entails rising demand for non-renewable minerals, largely extracted from the Global South. The larger the economic scale, the greater the material and energy demand—and thus the intensified pressure on peripheral territories.

These tensions structure the North–South divide that dominates international climate negotiations. While Global South states organize themselves into negotiating blocs—such as the

Least Developed Countries, the African Group, or the Alliance of Small Island States (AOSIS)—major economies advance their own green strategies: the European Green Deal, China's Carbon Peaking and Carbon Neutrality Action Plan, the Korean Green New Deal, or the United Kingdom's "Net Zero: Build Back Greener" strategy. Although presented as transformative initiatives, these programs tend to prioritize Northern concerns, deepen extractive patterns toward the South, and preserve colonial logics that externalize environmental costs.

This dynamic is also evident in instruments such as the Carbon Border Adjustment Mechanism (CBAM), which illustrates how climate governance can reproduce center-periphery asymmetries. While presented as a tool to prevent "carbon leakage" and incentivize global decarbonization, its design imposes a de facto carbon tariff on exports from the Global South without compensating for historical emissions. Countries such as Brazil, South Africa, India, and China face a "triple burden" of compliance costs, institutional constraints, and social inequalities, compounded by risks of trade retaliation (Zhang and Sovacool 2025). Moreover, the mechanism's carbon accounting methodology focuses primarily on direct emissions (Scope 1)², failing to recognize cleaner production models based on renewable electricity or biogenic carbon, which are common in the Global South (T20 South Africa, 2025). As Dani Rodrik (2023) argues, such measures operate as "beggar-thy-neighbor" policies, whereby the European Union protects its industrial competitiveness by shifting decarbonization costs onto exporting countries. The CBAM thus exemplifies how technocratic climate instruments, even when well-intentioned, tend to reinforce rather than reduce global inequalities.

These strategies reveal the absence of a robust framework of global regulation capable of balancing power, distributing costs, and ensuring just transitions. In this scenario, emerging economies face severe political constraints: they must pursue economic growth, manage social crises, negotiate financing, and simultaneously respond to climate challenges. The scope for reconciling these demands is narrow, and the international institutional architecture does little to expand it. An alternative policy mix centered on poorer countries and climate priorities is conceivable, but it would require substantial transfers of financial and technological resources from North to South to secure the investments needed for adaptation and mitigation.

This governance architecture yields two generalizable claims. First, countries with higher export dependence on CBAM-covered sectors (steel, cement, aluminum, fertilizers) will

² The Greenhouse Gas (GHG) Protocol classifies emissions into three scopes: Scope 1 (direct emissions from sources controlled by the entity), Scope 2 (indirect emissions from purchased electricity generation), and Scope 3 (other indirect emissions in the value chain). The current CBAM focuses primarily on Scope 1, which partially excludes emission reductions achieved through renewable electricity matrices in exporting countries.

experience greater terms-of-trade deterioration and lower fiscal capacity for green investment, controlling for GDP per capita and existing carbon pricing mechanisms. Second, climate governance mechanisms that rely on market-based, unilateral instruments without provisions for historical responsibility and financial transfers will tend to reproduce, rather than reduce, the North-South inequality in mitigation costs and adaptation capacities.

Two broad interpretations of this scenario can be identified. On the one hand, some actors view the climate crisis as an opportunity to accumulate wealth and reinforce geopolitical positions without questioning consumption patterns, energy distribution, or citizen participation. Pablo Bertinat and Jorge Chemes (2022) describe this approach—aligned with Global North proposals—as the “universe of corporate environmentalism,” which assumes that environmental costs are not transferred between countries and that technological progress can always compensate for ecological limits. Yet empirical reality shows that many states live beyond their ecological regenerative capacity by importing resources, energy, and sinks from other territories (Pérez Rincón 2012).

On the other hand, the “universe of popular environmentalism,” understands the crisis as civilizational and advocates for energy transitions centered on socio-environmental justice, cooperation, and metabolic reduction. This perspective argues that growth dynamics must align with the regenerative rhythms of natural resources and the sustainable use of nonrenewables resources (Bertinat and Chemes 2022). However, even countries pursuing this path face intense internal tensions: weak fiscal structures, extractive dependency, pressure from powerful actors, and urgent social demands that hinder long-term policy implementation. These domestic constraints reinforce the link between internal and international inequality, as political action in the Global South is limited both by global structures and by internal configurations.

Amid these tensions, the world order is undergoing profound transformations. The emergence of new powers in the Global South—largely absent from earlier phases of industrialization and previous technological revolutions—introduces novel dynamics in the distribution of power. Unlike the Third Industrial Revolution and the neoliberal globalization phase associated with it, the current wave of innovation—often framed as part of a “Fourth Industrial Revolution” intertwined with the energy transition—is not being driven exclusively by markets. Instead, there is a clear return of industrial policy, with states that once occupied subordinate positions now seeking to regain strategic capacity through regulation, subsidies, and technological planning. This shift is significant: productive and technological trajectories are no longer naturalized as automatic outcomes of competition, but recognized as arenas of political contestation. Yet this movement coexists with an international institutional environment that continues to reinforce corporate concentration and the disciplining of Southern economies.

Thus, economic inequalities tend to translate into political inequalities, shaping who decides, who pays, and who bears the costs of global transitions. Achieving the SDGs by 2030 will depend not only on technological solutions, but on political willingness to reform international economic rules, mobilize resources, and expand public investment at the global scale. Yet the efforts of transnational corporations to restrict technological diffusion in the Global South—now increasingly reinforced by industrial policies in the Global North—undermine the prospects for genuine multilateral cooperation.

Without a framework of global climate justice capable of addressing historical responsibility, redistributing costs, and expanding policy space for peripheral economies, even well-intentioned instruments—such as carbon pricing or green industrial strategies—risk reproducing existing asymmetries. The political arena thus emerges as a central site of struggle in the climate crisis: not only over emissions and technologies, but over power, sovereignty, and the conditions under which socioecological transitions can become both effective and just.

Conclusion

The structural inequalities of the global system reveal the persistence of an order that is incapable of responding commensurately to the climate challenge and that enables core countries to sustain environmentally unsustainable patterns of production and consumption while displacing ecological and social costs onto the Global South. As Ghosh, Chakraborty, and Das (2023) argue, this unequal architecture manifests across four converging dimensions: the disproportionate power of the Global North to degrade global commons; the deceptive mechanisms of climate diplomacy; the financialization of climate action, which increases emissions without delivering adequate resources for mitigation; and knowledge monopolies that restrict access to technologies crucial for the energy transition. Taken together, these dynamics demonstrate that the climate crisis is not merely an environmental problem, but a symptom of an economic and political order that reproduces colonial hierarchies under new institutional and discursive forms.

The three arenas analyzed—economic, technological, and political—converge around this diagnosis. In the economic arena, the green transition is embedded within deeply asymmetric global value chains, where the differential appropriation of resources, labor, and energy continues to favor countries with greater investment capacity and control over global financial infrastructures. The technological arena reveals a similar pattern: advanced digitalization and green technologies do not democratize innovative capacity, but rather consolidate new extractive frontiers based on data, critical minerals, and intellectual property, thereby reinforcing the technological dependence of the Global South. Finally, the political arena highlights how

multilateral institutions remain structurally aligned with Northern preferences, constraining the emergence of a genuinely equitable global climate regime.

In light of this scenario, advancing toward a global climate policy capable of overcoming the limitations of the nation-state and establishing common norms based on differentiated responsibilities and binding obligations becomes increasingly necessary. As Rodrik (2023) reminds us, the architecture of hyperglobalization was designed primarily by large corporations and financial actors, while social movements and environmental organizations have largely been confined to a defensive role. Reversing this asymmetry requires the democratization of global governance, the strengthening of transparency mechanisms, and the promotion of decision-making processes grounded in evidence rather than corporate interests.

At the same time, the reconfiguration of the global order requires countries of the Global South to break with postcolonial dependency and define their strategic priorities independently of the agendas of Western partners increasingly marked by internal crises and declining legitimacy. Achieving this objective demands the transformation of multilateral institutions and the construction of more horizontal relations, supported by South–South cooperation that leverages natural resource endowments, strengthens domestic technological capabilities, and reduces external vulnerability (Azad and Chakraborty 2023). Within this framework, the material and energetic abundance of the Global South could become a source of bargaining power and, potentially, a foundation for a more just global transition.

Conversely, the Global North would need to undergo a selective and socially regulated contraction of material throughput, redirecting its productive structures toward sectors that prioritize social well-being over unlimited accumulation. This process entails the reconfiguration of energy, urban, and transport systems in ways consistent with a “living better with less” paradigm (Pérez Dueñas and Marcellesi 2010). Without a planned reduction of the economic metabolism of affluent economies, a return within planetary boundaries remains unattainable.

The magnitude of global inequality underscores the urgency of these transformations. Eighty-three percent of countries—representing 90 percent of the world’s population—meet the threshold used by the World Bank definition of high inequality (G20 Extraordinary Committee of Independent Experts on Global Inequality 2025). While global inequality between individuals has declined modestly due to the growth of economies such as China, internal inequality has intensified, and the income gap between the Global North and South remains profound. The wealth of just 3,000 billionaires amounts to 14.6 percent of global GDP (Oxfam 2025), while 2.3 billion people face moderate or severe food insecurity. These disparities are not market anomalies, but structural expressions of a model that treats the planet as infinite and disposable, and the majority of humanity as expendable.

In this context, the construction of alternatives requires a fundamental rethinking of the foundations of the global economy. Reducing the material scale of the world economy, strengthening community-based systems of production and circulation, and subordinating the logic of capital to the requirements of social reproduction constitute essential steps toward an ecologically viable and socially just transition. Experiences that conceptualize money as a means of exchange rather than an instrument of accumulation—and that seek to counteract induced scarcity and structural indebtedness—point to emerging pathways for reorganizing the economy from below (López Terán 2021).

In sum, confronting the climate crisis necessarily entails confronting the crisis of the global order that produces it. In the absence of a profound redistribution of economic, technological, and political power—both between and within countries—the green transition will continue to reproduce the very inequalities it claims to address. Only a global project that subordinates capital accumulation to the requirements of social reproduction can create possibility of a future within planetary boundaries.

About the Author: Gala Kumec is a PhD candidate in International Relations at the Escuela de Política y Gobierno, Universidad Nacional de San Martín (UNSAM), Argentina. Her doctoral research examines the intersections between climate crisis, energy transitions, and global inequality from a critical political economy perspective, with a particular focus on extractivisms, technological dependency, and visual narratives shaping climate action in the Global South.

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